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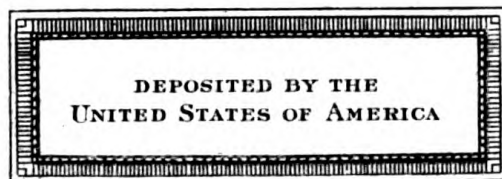
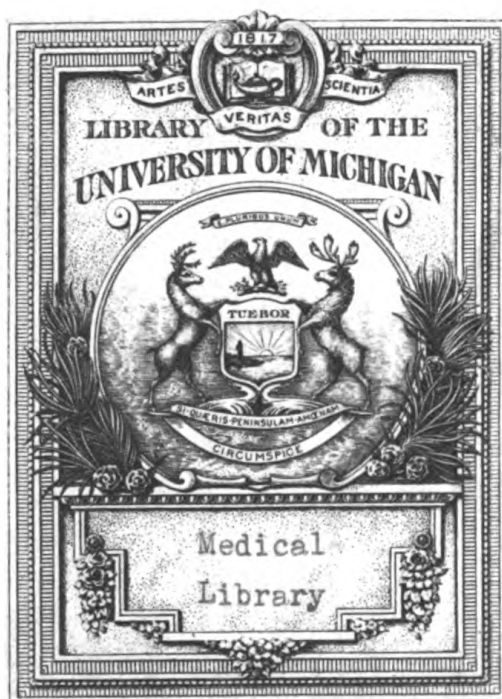
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VOL. 47

JANUARY—FEBRUARY 1947

NO. 1

John H. ...

**UNITED STATES
NAVAL MEDICAL
BULLETIN**

**THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**



BIMONTHLY

**DIVISION OF PUBLICATIONS
BUREAU OF MEDICINE AND SURGERY**

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.



Because the supply of certain numbers of the BULLETIN is exhausted and because of the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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II

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NAVAL MEDICAL BULLETIN

**PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY**

VOLUME 47

NUMBER 1

Special Number on
Advances in Medicine
During 1946



JANUARY—FEBRUARY 1947

Bimonthly

**BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.**

NAVMED 112



COVER PHOTOGRAPHS

The cover pictures illustrate the important task of feeding patients in the Navy. In the upper picture, taken at a naval hospital, food is being transferred from a portable steam table to the patient's tray. In the lower picture a nurse on a hospital ship in Japanese waters feeds a patient unable to use his hands.

—Official U. S. Navy Photos.

The "Prayer From the Navy Wounded" appearing opposite the initial page of the Special Articles section of this issue of the "Bulletin" was published in the May 1946 number of the Proceedings of the U. S. Naval Institute and is printed through the courtesy of the United States Naval Institute and the author, Commander J. M. Stuart, U. S. Navy. It will be noted that the poet has ingeniously introduced the name of one of the Navy's hospital ships in each line. The prayer has been printed on a separate sheet so it can be taken out if desired. It was planned to reproduce it in colors but the cost of this was prohibitive. Enlarged and illuminated in colors it would, when framed, be suitable for placing in the entrance area or waiting rooms of naval hospitals or on hospital ships. It is hoped that a few copies may be obtained for this purpose. The Chief of Navy Chaplains has expressed an interest for its use in Navy chapels.

*Medical
Department
U.S. Navy*

TABLE OF CONTENTS



PREFACE	Page III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Some Future Policies of the Medical Department of the Navy—C. A. Swanson	1
The Plastic Ocular Prosthesis—John V. Niiranen	5
Notes on Spinal Anesthesia for Internes Using Procaine or Novocaine—Angus M. Brooks	23
Psychometric Examinations Aboard a Destroyer—Alfred M. Bongiovanni	27
The Laboratory Diagnosis of Diphtheria—Donald D. Albers	33
Diabetes Mellitus in a Naval Hospital; Review of Fifty Consecutive Cases—Joseph J. Furlong	42
Research in the Naval Hospital—Harold M. Hildreth	52
A Description of Disqualifications of Enlisted Applicants for Submarine Training—Charles W. Shilling and Neil R. Bartlett	59
Epidemic of Prickly Heat on Aircraft Carrier—George B. Ribble, Waldo S. Luedemann and Sherman M. Peabody	77
Sclerosing Osteomyelitis of Garré With Report of a Case—Harold A. Lyons	83
A Technique of Local Use of Penicillin in the Operative Treatment of Chronically Infected Ingrown Toenails—Charles P. Lape	90
The Wartime Log of a United States Navy Hospital Ship to 30 June 1943; Part III—Richard A. Kern and Melville J. Aston	94

EDITORIALS

New Publication Dates of The United States Naval Medical Bulletin	109
Graduate Training in the Navy Medical Corps	110
Ascorbic Acid in the Prevention and Treatment of Disease	110
Physical Defects Found in Drafted Men in the United States in World Wars I and II	112

ADVANCES IN MEDICINE AND THE MEDICAL SCIENCES DURING 1946

	Page
Medicine—Tropical Medicine—Naval Medicine—Aviation Medicine—Neuropsychiatry—Surgery—Neurosurgery—Obstetrics and Gynecology—Dentistry—Cancer—Ophthalmology—Laryngology—Otology—Anesthesia—Preventive Medicine—Dermatology and Syphilology—Radiology—Anatomy—Physiology—Pathology—The Nobel Prize in Medicine, Chemistry and Physics, and Some Other Medical Prize Awards in 1946	114

CLINICAL NOTES

Fatal Bullous Dermatitis With Multiple Lesions of the Mucous Membranes; Therapeutic Failure of Sulfadiazine and Penicillin—Patrick J. Fitzgerald	134
Pericarditis During Penicillin Treatment for Syphilis—Hugh G. Whitehead	141
Treatment of Erysipeloid of Rosenbach With Penicillin—Lewis K. Ferguson, Eugene A. Hand, and James H. Strauch	150
Intensive Autohemotherapy in the Treatment of Acne; a Preliminary Report—Bernard Ross and Paul J. Richeson	154
A Case of Granuloma Pyogenicum Treated Successfully With Penicillin—Lloyd O. Rupe and Howard J. Lockward	156
Lymphogranuloma Venereum; Report of a Case Treated With Penicillin and Sulfadiazine—Moses J. Entin and Robert D. Boles	157
Tinea Capitis—William D. Stubenbord	159
Fulminating Hemolytic Staphylococcus Aureus Infections; Recovery Following Penicillin Therapy—Frank V. Theis and Shervert H. Frazier	163

MEDICAL AND SURGICAL DEVICES

An Improved Separating Medium for Acrylic Resin—Frank E. Jeffreys and LaMar W. Harris	171
--	-----

BOOK NOTICES

White House Physician, McIntire—The Human Ear in Anatomical Transparencies, Polyak—Ophthalmology in the War Years, edited by Wiener—The Normal Encephalogram, Davidoff and Dyke—Hippocratic Wisdom, Petersen—Diabetes, John—Physical Diagnosis, Major—Treatment of Bronchial Asthma, Derbes and Engelhardt—Not by Bread Alone, Stefansson	173
--	-----

PREVENTIVE MEDICINE

Toxic Effects of Arsenical Compounds as Employed in the Treatment of Syphilis in the United States Navy, 1945— <i>Otto L. Burton, George W. Justyn, and Laura T. Anderson</i>	180
Influenza Vaccination: Comparison of Intracutaneous and Subcutaneous Methods— <i>David W. Van Gelder, Frances S. Greenspan, and Napoleon E. Dufresne</i>	197
Incidence of Venereal Disease in Separatees Examined at the U. S. Naval Personnel Separation Center, Jacksonville, Florida— <i>Lester D. Bibler and William H. Goley</i>	207
NOTES ON CONTRIBUTORS	208

PRAYER FROM THE NAVY WOUNDED •

I am wounded, lying in the tropic darkness.
Who will deliver me, **O**h **G**od? **I**s there no **H**ope?
Is there no present **S**olace from the flame that burned me,
No heaven-blessed **R**elief for aching steel-torn flesh?
Surely the **A**l-**H**ighest in **H**is **S**anctuary,
He who is my ever present **C**onsolation,
My **R**efuge, **W**ho is **B**enevolence indeed,
Will send me one **S**amaritan to bind my wounds.
For **I** have sung **H**is **M**ercy long as **C**hristians should,
I have known **H**im **B**ountiful, yea, my enduring life,
Have dwelt before **H**im in old faith's **T**ransquillity.
Rescue me, **L**ord, **C**omfort me in my deep distress;
Salve my wounds; bear me up to some sailor's **H**aven,
Or to the sweet **R**epose that **T**hou hast promised me!

Commander J. M. Stuart, U.S. Navy.

U. S. NAVAL MEDICAL BULLETIN

VOL. 47

JANUARY-FEBRUARY 1947

No. 1

SPECIAL ARTICLES



SOME FUTURE POLICIES OF THE MEDICAL DEPARTMENT OF THE NAVY

C. A. SWANSON

Rear Admiral, Medical Corps

Surgeon General, United States Navy

The period of demobilization after World War II is virtually at an end. The Medical Department of the Navy now faces the problems of providing medical and surgical care for the sick and injured of a postwar Navy of approximately 500,000 officers and men, and 100,000 officers and men of the Marine Corps. As far as personnel and facilities permit the care of dependents will also be continued. In addition to this, while we look forward to peace, it must be remembered also that the Navy is a military organization and must always be ready to meet the requirements of modern war.

At this time it is important that the Medical Department of the Navy look forward into the future and base its plans upon certain general principles and policies. It is also desirable that all members of the Medical Department have knowledge of these broad general policies and aims. Only in this way can we intelligently work together for our objective, which is to give the best medical, surgical, and dental care possible to the Navy, and through preventive measures maintain its health at the highest level attainable.

One of the first things we need in order to achieve this result is stability in the Medical Department itself. One of the policies, therefore, is to reestablish the regular alternating periods of duty ashore and afloat for medical officers and other members of the Medical Department, which have been to a considerable degree disrupted by the war and the demobilization period. This will enable personnel to make appropriate plans for the establishing of homes and the schooling of their children. As far as practicable, when an officer returns

from sea duty or shore duty beyond the seas he can expect to remain ashore for a reasonable period in one locality with the expectation of not being moved except in a real emergency. This will give him an opportunity of securing a place to live, to place children in school, and to carry on professional work and training in one field for the period of his shore duty. All of this will mean a great deal for morale, and for satisfaction in the Navy as a career.

Another policy will be that of opportunity for post-graduate training and specialization. Our naval hospitals, and also civilian institutions, will be used to the limit for training in all specialties, for regular residencies, and also for such training as is obtained from duty where opportunity for special experience exists.

An essential part of all medical work is accessibility to the best of medical literature. No other profession has to spend so much time with professional books and professional journals in order to keep abreast of the times. The Medical Department of the Navy first established medical libraries in all its activities in 1842 when the first Chief of the Bureau of Medicine and Surgery made this one of his particular policies—a very far-reaching and farsighted one. This policy has been maintained since and will continue. Evidence of its modern development is shown by the recent list of minimal library requirements for naval hospitals and the extensive book list of our section of the Catalog of Navy Material. Not only books, but the leading medical journals of the world are made available.

Another policy will be arrangements for a larger use of non-catalog drugs and remedies than has been the custom in the past. This does not mean experimentation in the use of untried remedies, but it does mean an opportunity for the medical and dental officers of the Navy to have early access to the newest and best remedies being produced. At present every effort is made to add promptly to the Catalog of Navy Material new remedies of proven value, and non-catalog items may also be supplied when it is believed there is need for them. There will be abuse of the employment of non-catalog drugs if therapeutic idiosyncrasies are carried too far. This can, however, be dealt with by the use of common sense in the local administration of the Medical Department activity concerned.

Members of the Medical Department of the Navy can in no way be isolated from their counterparts in the civilian population. A medical officer in the Navy is a doctor, and his practice in medicine and surgery, except as modified by certain military conditions, is exactly the same as that of the civilian physician and surgeon. An appendectomy done in the sick bay of a ship is done under different conditions than one done in a hospital ashore, but the remedies used, the skill and the techniques, the knowledge as to diagnosis, and the post-

operative treatment are the same. One of our policies will be to retain this sense of solidarity with the civilian medical, dental, pharmaceutical, and nursing professions.

The medical schools, the dental schools, the colleges of pharmacy, and the schools of nursing, are the principal sources of supply for professional personnel of the Medical Department. Effective liaison with these schools to obtain an orderly flow to fill the various corps of the Medical Department of the Navy must be established and maintained. The prospective members of the Corps for sciences in the field allied to medicine, also must be shown the opportunity the Navy has to offer as a life career for them. One of the most serious and urgent problems at present is the insufficient number of medical officers, dental officers, nurses, and hospital corpsmen. The assurance of professional opportunity, adequate pay and promotion, the provision of Government housing, and stable living conditions are needed to attract the requisite number of candidates for all branches of the Medical Department. Here we must compete with the opportunities in civil life and it is imperative that we do all we can to make our opportunity equal to those of the country as a whole.

Another policy of paramount importance is the continuance of contact with the Naval Reserve. Our Reserve officers of the Medical Department are now mostly returned to civil life. Though no longer on active duty their services in the past and during the greatest of wars cannot be forgotten. They are still members of the Medical Department of the Navy, a very important part of it. Every opportunity for professional relationship should be used to make the Reserve officer on inactive duty feel that he is still a necessary part of the organization that keeps the Navy in physical readiness to carry out its numerous and vital duties to the country.

We have in the Navy a large number of dependents—the wives, children, and the dependent parents of the officers and men in the service. In isolated stations where no other medical care is available, professional care for them is necessary. From the standpoint of morale, some measure of dependents' care is probably desirable throughout the service. At present, the Medical Department is carrying on a large amount of dependents' care with only the facilities for the care of the Navy and Marine Corps personnel itself. This burden, however, is too great and it seems certain that if this dependents' care is to be continued and extended, additional funds and personnel must be obtained and steps in that direction are almost certain to be one of the future developments. It should be done, however, in a clear and open manner and proper estimates of the needs for both money and personnel to meet this additional responsibility must be laid before Congress, and legalized and approved in every respect.

The Medical Corps of the Navy has carried on much vital medical research. This must continue but in addition contact with medical research in civilian organizations, the National Research Council, and other appropriate groups must be closely maintained. The results of this research must also be disseminated and the interchange of professional ideas encouraged through the official publications of the Medical Department as well as the professional books and journals which are fully supplied to all ships and stations.

The Navy is a very complex organization and its ships and stations are found in all parts of the world, not omitting even the Arctic and Antarctic. One of the policies to which we must closely adhere to is to see that all parts of the Navy are equally well served, that the medical departments of ships are not slighted in favor of shore establishments, and that the demands and needs of aviation medicine, amphibious medicine, and submarine medicine are not neglected. One of our prominent policies must be to maintain a suitable balance between all parts of the medical organization so that the Navy can be properly served by it in peace or war.



THE PLASTIC OCULAR PROSTHESIS

JOHN V. NIIRANEN

Commander (DC) U. S. N.

The Navy technique for preparing a plastic ocular prosthesis will be described from the standpoint of Navy and Marine casualties, whose problems differ qualitatively from those of civilians. Service personnel are available for treatment and fitting at all times. They are in close contact with patients who have like disfigurements. Injury to the orbital area is often much more extensive for service personnel, and the restorative problem consequently more difficult.

The ocular prosthesis goes back into antiquity. Early restorations, crude but often ingenious, were painful lumps or devices of metal, enamel, stone, glass, and crystal. Starting in the sixteenth century, the forerunner of the modern glass eye was being made on a large scale. At the outbreak of World War II, stock glass eyes and the materials for making them were in short supply. For this reason, and because of the inherent shortcomings of stock glass restorations, the Navy began its search for a more satisfactory prosthesis.

No important improvement over glass restorations had been made until very recent years. S. Wardman, in the March 1944 British Journal of Ophthalmology, reported techniques for two types of plastic eyes developed in England; and in April 1944, J. Penn, in the Brenthurst papers of Johannesburg, South Africa, reported still another procedure. Using basically this latter technique, officers attached to the U. S. Naval Dental School, National Naval Medical Center, Bethesda, Md., began in that same year the school's own search for an adequate plastic restoration for Navy and Marine casualties.

The quest has been for a prosthesis that incorporates the qualities of performance, comfort, and esthetics. It was learned early that an acrylic eye, properly made, is almost indestructible; that comfort is achieved only through individualized fitting; and that by far the most important unsolved esthetic problem was mobility of the prosthesis. The technique taught at the U. S. Naval Dental School and described in this article is the refined product of continuous laboratory and clinical research in materials, equipment, and procedures.

The surgery which precedes the ocular prosthesis, and the resulting characteristics of the ocular stump, are important to the success of the

restoration. The necessity, therefore, for cooperation between the ophthalmologist and the dental officer is immediately apparent. The experience at the school is that it is best for the average case to be referred by the ophthalmologist for the restoration 4 weeks after surgery.

TECHNIQUE

The basic steps of the technique are :

1. Preparation of patient: Positioning, physical and mental comfort, examination of socket.
2. Taking alginate impression of the prepared eye socket.
3. Preparation of stone working mold from alginate impression.
4. Pouring wax in mold to form basic pattern for restoration.
5. Modification of anterior portion of wax pattern, and trying *in situ*, to simulate remaining eyeball and to restore the contour of tissues immediate to the orbital cavity.
6. Duplicating the corrected wax pattern in pigmented methyl methacrylate, by injection molding.
7. Orientation of iris with prosthesis *in situ*.
8. Preparation of master stone mold.
9. Painting an individualized iris on paper disk with water-color pigments.
10. Preparation of anterior scleral portion of prosthesis: Insertion of iris, painting of scleral colors and blood vessels on restoration.
11. Addition, by injection molding, of clear methyl methacrylate over prepared and painted scleral portion.
12. Polishing of the completed plastic ocular restoration.

THE PATIENT'S FIRST APPOINTMENT

The patient brings his written medical history with him at the time of his first appointment. He is seated in the dental chair. Before examination the operator looks briefly through the medical record; detailed study of the record can usually wait until after the patient has left. The surgically prepared eye socket is examined for movement of the stump, degree of healing, possible need for further surgery, and the general characteristics of the orbital cavity. The operator also makes his own estimate of the patient for other possible physiological and psychological problems presented. At this first visit, three photographs of the patient's orbital regions are taken. A full-face and a profile photograph will serve as a preresoration record.

The third picture, life-size, includes a millimeter rule held at the temple near the remaining eye at the plane of the iris, for measuring the diameter of the iris (fig. 1). The patient is shown pre- and post-

restoration photographs of other patients like himself, it is explained to him that there will be no pain or discomfort, and he is encouraged to talk with fellow patients in his ward on the merits of the plastic ocular prostheses which they are wearing. Thus prepared, the patient will usually return, on his second visit, ready to cooperate fully. The patient is dismissed from this first visit, and the operator makes a more careful study of the written medical history for possible additional light on the observations made in examining the socket.



FIGURE 1.

THE IMPRESSION

At the second visit the operator begins the series of exacting procedures, some of which will require the full and intelligent cooperation of the patient. The orbital cavity is again examined, this time to plan the taking of a complete and accurate mucostatic impression.

Equipment and materials.—The equipment required includes such standard laboratory items as interval-timer, plaster-bowl and spatula,



FIGURE 2.

and a 100-cc. graduate. Two special pieces—a syringe and a confining tray—are also required (fig. 2). The glass syringe (90 cc.) terminates in an ordinary nursing nipple with the end severed. The syringe can be made by a glass blower at small cost. The confining trays (one should be made for a left and one for a right eye) are made by conforming two thicknesses of base-plate wax to an average orbital area. A handle is added, and the wax is duplicated in clear methyl methacrylate.

Preparing the patient.—While the patient is still standing about, the operator observes (without the patient's being aware of it) the midline or "normal" position of the remaining eye; essentially, this is determined by the usual position of the patient's head as he looks straight ahead. The patient is then seated in a dental chair in an upright position facing an area devoid of bright lights or reflections. A small piece of tape is placed on the wall in front of him so that when his remaining eye is fixed on this prescribed point, it is in midline position. The patient is told he will shortly be expected to keep his gaze fixed on the point for 6 minutes—the time necessary for taking the impression. It is explained to him that the purpose will be to prevent distortion of the impression material by movement of the ocular stump during the impression-taking. He is told to blink as few times as possible during this step, and that there will be no pain or discomfort—that the alginate will merely feel cool to the mucous membrane of the socket. Anesthesia is not used, except for uncooperative young children. The eye socket and surrounding tissues are not lubricated, because the alginate will not adhere to the tissues or cilia, and lubrication would reduce the accuracy of the impression.

Mixing the alginate.—A tube of alginate¹ is added to the correct amount of water to produce a smooth creamy mix of a consistency considerably softer than that required for dental impressions, and the entire mix transferred into the syringe.

Taking the impression.—Any excess lachrymal secretion in the ocular cavity is removed gently with sterile gauze. From this point on until the alginate is set, the operator obviously must not obstruct the patient's view of the designated spot.

While the patient's palpebrae are held apart by an assistant, the operator injects (fig. 3) the soft alginate with minimum pressure, slowly "flowing" the impression material into any undercuts that may be present, without entrapping any air bubbles, until the cavity is full. The remainder of the material in the syringe is flowed over the ex-

¹ For several of the steps outlined in this report, only one particular brand of material in each case has been found to give most satisfactory results. This observation applies to: The alginate impression material; the methyl methacrylate; the pigments in the undercut surfaces in the iris countersink; the iris; the blood vessels, and the scleral tints.



FIGURE 3.

ternal surfaces immediate to the orbital cavity and the whole mass is confined with the clear plastic tray, still with minimum pressure, for 4 minutes. The operator stands behind the patient and holds the tray lightly in place, with his hand resting on the patient's face, steadying both the patient's head and the tray. This helps the patient to keep his gaze fixed on the designated spot; he will not move his head or eye, as is the tendency when the operator leaves him and moves about the room. The impression is removed by gently drawing it outward and toward the nose, at the same time manipulating the surrounding area to free the tissues. The impression is carefully checked by comparing it with the socket (fig. 4) for voids, which may have resulted from entrapped air, and for distortion or other inaccuracies caused by muscle movement or by improper consistency of the impression material.

Hardening the impression.—The impression is rinsed with tap water to remove any secretions that may have adhered to its surface. The impression is then immersed in a hardening solution and after it has surface-hardened, it is rinsed lightly, and excess moisture removed.

THE WORKING MOLD

Pouring the mold.—Any excess alginate impression material extending over the edge of the confining tray is trimmed off. The tray and impression are boxed with wax. Stone is mixed according to the manufacturer's specifications and is poured and vibrated onto the boxed impression (fig. 5) until all parts of the impression are covered with at least 10 mm. of stone.

Plaster matrix or key.—After the stone has hardened, the tray, boxing wax and alginate impression are removed from the mold. The mold is then trimmed and bevelled on a model trimmer. Four notches at the edge of the base will facilitate assembly of the mold later in a key. The outside of the base of the mold is lubricated with heavy petrolatum. A plaster key is formed around the base for the purpose of holding the assembled parts of the mold in proper relationship after it has been divided into two (sometimes more) sections.



FIGURE 4.

Dividing the working mold.—After the plaster key has set, the stone working mold is removed, and is sawed and broken into two sections through a plane bisecting the eye socket vertically. The saw-cut should extend through the mold except for the last 5 mm. of the base. This weakens the mold so that it can be gently broken in two by hand with little effort, but still leaves a positive contact between the pieces which allows the mold to be reassembled in the key with its original dimensions. After the two pieces are broken apart, they are washed in running tap water with a brush to remove any remaining particles of stone or alginate impression material.

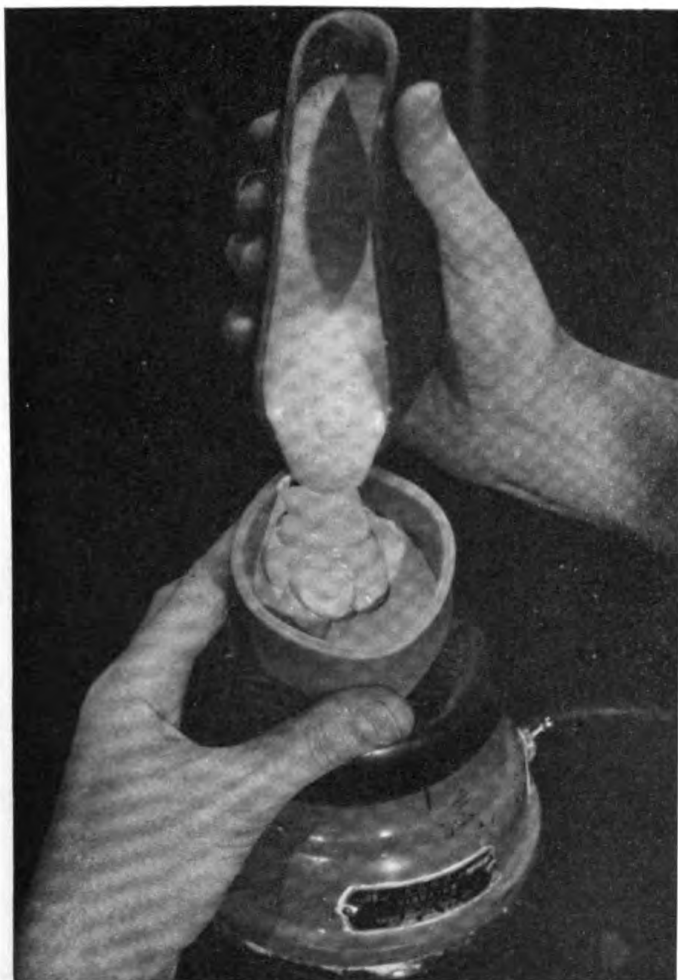


FIGURE 5.

Reassembling the mold.—The two sections of the mold are dried. They are lubricated thoroughly with liquid petrolatum, which will serve as a separating medium. Excess lubricant is removed. The sections are repositioned accurately in the plaster key. Wax wedges are inserted at the edges of the sawed slit to insure that the sections remain in place, and to prevent molten wax from flowing out of the mold.

THE WAX PATTERN

Pouring.—Pink base-plate wax is heated and flowed slowly into the lubricated mold, which is “rotated” and tilted at the same time to insure accurate adaptation. The mold is filled with a slight excess.

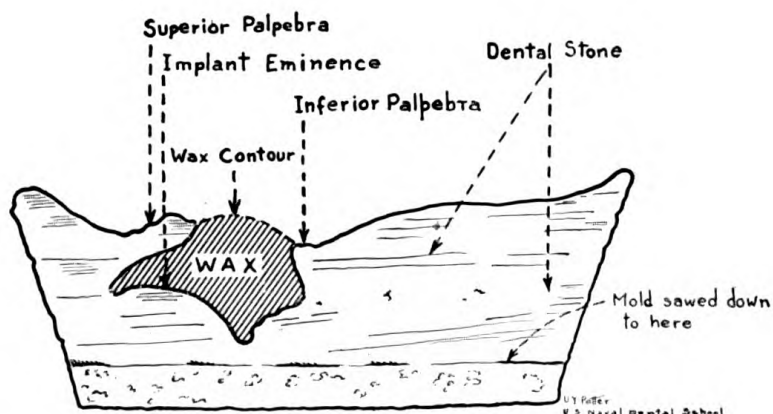
Removing excess wax.—The mold and wax are chilled for a few minutes under cold running tap water. The excess wax is removed with a *dull* carving instrument (fig. 6) until the outer borders of the palpebrae are free of it. (A slip with a *sharp* carving instrument



FIGURE 6.

could scratch the stone mold and allow sharp particles to become imbedded in the wax pattern.) The wax between the stone palpebrae is contoured to approximate the convexity of a normal eye (fig. 7).

Removing and trimming the wax pattern.—The wax and mold are now completely chilled, preferably in ice water or in a refrigerator. To remove the pattern from the mold, the plaster key is removed and sharp instruments inserted at each side, between the two portions of the stone mold, and even stress is applied to separate the mold from the pattern. If undercuts are present which offer resistance to separation and consequently threaten distortion of the wax pattern, it may be necessary to make one (or two) new lines of cleavage. The new line of cleavage is started with a saw, cutting from the side toward the wax pattern, and the break is completed by tapping the mold lightly with a blunt instrument. The “flash”—excess wax which filled the slit



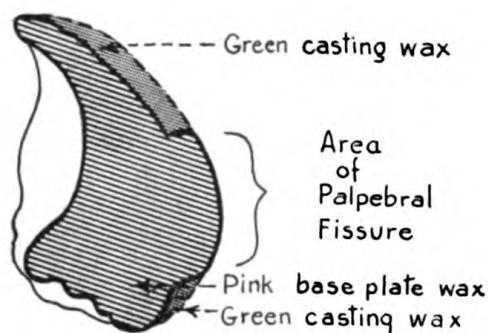
VERTICAL CROSS SECTION OF WAX PATTERN IN STONE MOLD

FIGURE 7.

produced by the sawing—is trimmed from the wax pattern. The pattern is compared with the stone working mold, for possible distortion or voids.

Contouring and trimming the pattern. On the anterior surface of the wax pattern the area of the palpebral fissure will be represented by a slightly raised portion. Green wax is added to eliminate the “shoulder” (fig. 8), and to make this surface correspond to the contours of the remaining eye. This use of contrasting colors in the two waxes is of considerable help later in making

the necessary additions and subtractions for contouring a comfortable and accurate wax pattern. At the patient's third visit, the wax pattern is lubricated with liquid petrolatum to facilitate insertion and removal, and inserted gently into the eye socket—first under the superior, then the inferior, palpebra. The pattern is removed, trimmed, washed and lubricated, and reinserted as many times as necessary for contouring. Medically, the pattern should be trimmed to touch but not overlap the caruncula; laterally, it should extend as far as the original



Vertical Cross Section of Wax Pattern

U. Y. PATTAY
U. S. Naval Dental School

FIGURE 8.

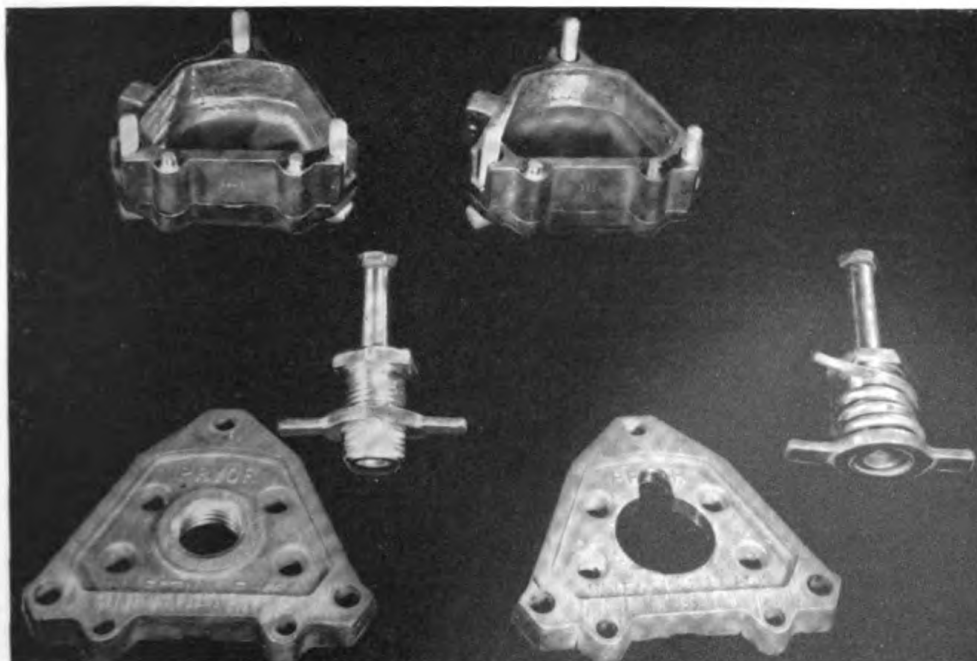


FIGURE 9.

impression. The wax pattern *in situ* is compared with the remaining eye, viewed from all angles. The contours of the two "eyes," and of the palpebrae and surrounding tissues, should correspond closely. As a rule it will be found necessary to remove excess bulk from the anterior temporal half of the pattern.

The flask.—A Pryor-type injector flask is modified as follows: A snug-fitting coil of copper tubing is soldered around the injector plunger barrel, to act as a water jacket for this cylinder. The hole in the flask lid is enlarged about 15 mm., with an additional smaller half-circle removed at the periphery of the hole (fig. 9), to permit embedding the cylinder and coils in the stone with no metal-to-metal contact.

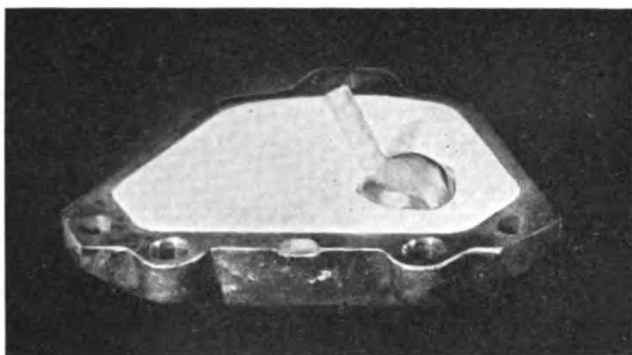


FIGURE 10.

Investing the wax pattern.—Dental stone is mixed and vibrated into the bottom section of the flask. The wax pattern is held in the operator's fingers, posterior side up, and enough stone is flowed and vibrated over the surface to cover it with a layer approximately

3 mm. thick. The pattern is set in the stone flush with its periphery, and the stone allowed to set at least 15 minutes. A wax sprue $\frac{3}{16}$ inch in diameter is added at the angle necessary to bring its top near the center of the flask (fig. 10). (Two or three wax patterns, with the tops of their sprues joining, can be processed in the flask simultaneously.) The surface of the stone in the bottom section of the flask is painted with a 15- to 20-percent solution of sodium silicate and allowed to dry thoroughly. It is then immersed in tap water a few seconds, and the excess water removed. The middle section of the flask is set upon the lower section, with clean metal-to-metal contact of the adjoining surfaces. Stone is mixed and vibrated into the upper half until the level is one-half inch below the top level of this section. The end of the sprue must be in evidence; if it extends above the level of the stone it is trimmed off flush after the stone has set. A third mix of stone is vibrated in excess amount over the set stone of the upper half of the flask. The modified lid and cylinder are assembled, with the cylinder through the hole in the lid, and the wings then screwed onto the bottom of the cylinder, underneath the lid. With the plunger inserted and held down the full depth of the cylinder, the assembly is settled down onto the stone-

filled flask, so that the plunger is in contact with the exposed end of the wax sprue. With the lid accurately seated, the cylinder is vibrated gently by hand to insure that the wings rest on the top of the set stone, and that the unset stone completely insulates the cylinder, wings and plunger from the lid of the flask.

Separating the flask.—The two “halves” of the flask are separated and the wax pattern and sprue removed mechanically. If the pattern is removed without distortion, it can be saved for possible future re-use in the event the patient loses his restoration. Hot tap water is flowed through the sprue channel, from the mold side out, to remove all traces of wax or stone particles from the mold, sprue channel and cylinder.

THE PROSTHESIS

Packing the flask.—Pure tinfoil is the preferred separating medium. Rubber-dam (thin) may be used as the separating medium on the lower half, and sodium silicate (15 to 20 percent solution) for the upper; or sodium silicate may be used for both halves of the mold.

Fluorescent methyl methacrylate, pigmented to a basic scleral color by the manufacturer, is used as the scleral portion of the prosthesis. The mixture of monomer and polymer, prepared according to the manufacturer's instructions, is ready to pack when it no longer will adhere to a clean steel instrument. Contaminating the mixture is to be avoided at all stages. It should not be handled with the fingers, but with a clean steel mixing spatula, and celophane that has been immersed in water and then thoroughly wiped on a clean dry cloth to remove excess surface moisture. In packing the upper half of the flask, the mixture is forced into the full length of the stone sprue channel. The two halves of the mold are *underpacked*, however, so that when the flask is bolted, there will not be an excess of material to form “flash” which would keep the two halves from closing together accurately. The flask is bolted together, the cylinder filled to within $\frac{5}{8}$ inch of the top, and the plunger inserted. The spring pressure jack is applied, and turned down to exert the required pressure on the plunger as indicated on the guide posts. A better product will result if at this point the packed flask, with the acrylic thus compressed, is allowed to stand for at least 1 hour; overnight is permissible.

“Curing” the acrylic.—The flask is set in a room-temperature water bath, with the water level 1 inch below the top of the flask lid. Rubber tubes are attached to the copper cooling jacket, and cold tap water started flowing through the coils (fig. 11). The water bath is thermostatically controlled to raise the water temperature approximately 1.8° F. per minute. When the boiling point is reached, the cold-

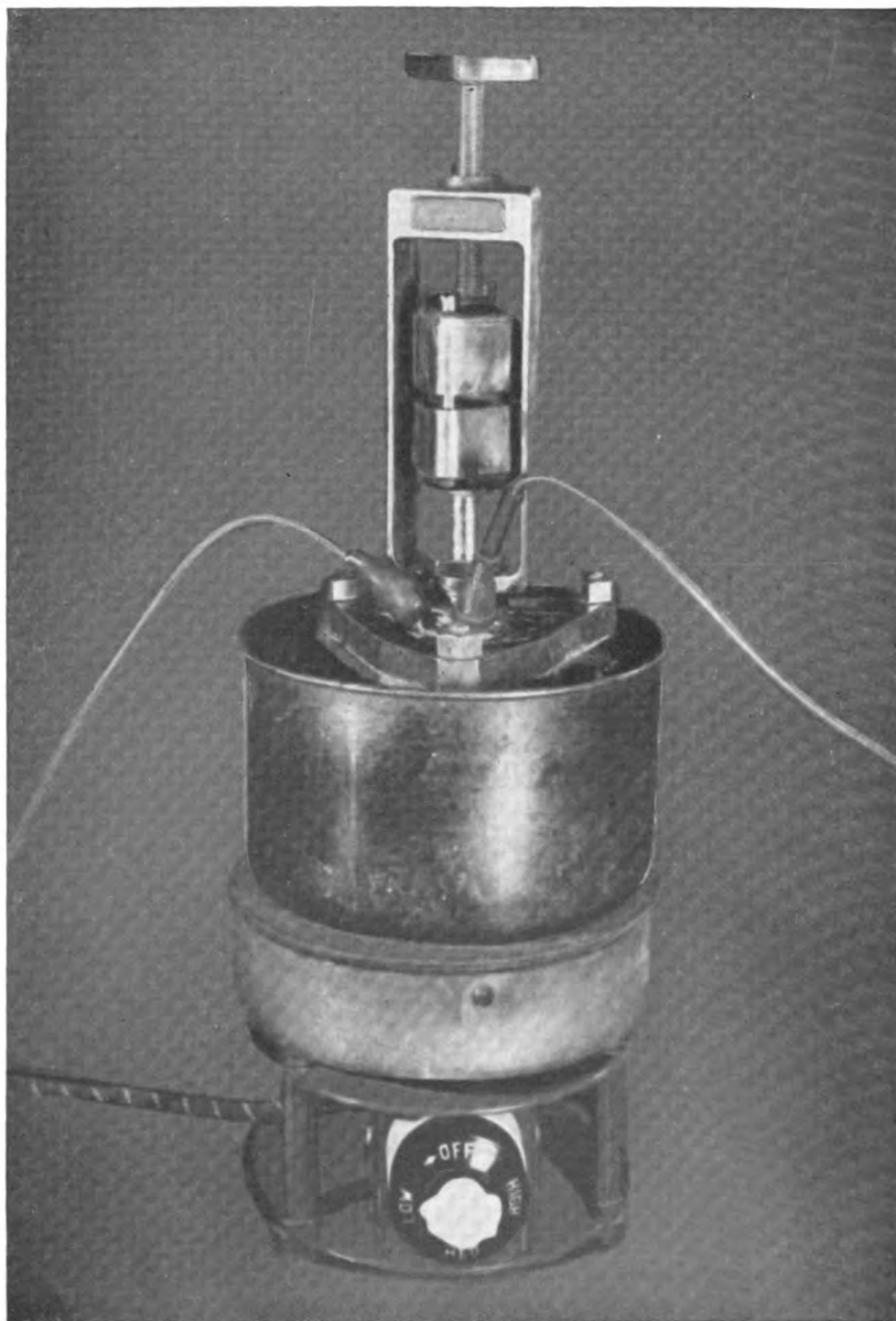


FIGURE 11.

water flow through the coils is stopped, and the flask is allowed to remain in the boiling water for an additional 30 minutes. The flask is next immersed in cold water for 15 minutes, and then dismantled. On separation of the two halves, the plastic prosthesis will be found held in the upper half by the continuous sprue; it will be necessary to remove the lid and cylinder, and to break the stone mold, to remove the prosthesis.

Trimming and polishing.—The sprue, “flash” if present, and any protruding defects are trimmed off with mounted stones; care must be taken to avoid altering the original contours. In polishing the restoration a soft rag wheel is used, with wet flour pumice under light pressure, and with the engine at slow speed to avoid “burning” the surface of the acrylic. The irregular posterior surface is similarly polished, but with felt cones and fine bristle brushes. A high surface polish is then imparted with dry rag wheels, cones and brushes, and wet whiting. The high polish will make it unnecessary to lubricate the acrylic eye or the eye socket at any subsequent stage.

PERIOD OF ACCOMMODATION AND FITTING

It will now be necessary for the patient to wear this uncompleted whitish prosthesis, under a loose patch covering the orbital region, for from 7 to 10 days. (Two to 3 days will suffice if he habitually wears a prosthesis of any type.) During the entire 7- to 10-day period the patient will report at least every 48 (preferably every 24) hours. The operator will inspect the socket at each visit, and will usually find it necessary to modify (as a rule, reduce) the anterior surface of the prosthesis to accommodate the returning tissue and muscle tone of the socket and surrounding tissues.

THE IRIS—POSITION AND SIZE

After changes in the ocular cavity and surrounding tissues cease, and the final adjustments for contour, comfort, and mobility have been made, the prosthesis is ready for adding the iris, scleral colors, blood vessels, and clear portion (cornea).

Locating the iris.—The operator determines the iris position, using the remaining eye as a guide. With the prosthesis *in situ*, the pupil position, and the distance of the iris from the medial and lateral canthi and from the edge of the inferior palpebra, are marked on the prosthesis by small waterproof dots. The restoration is removed, and a circle representing the iris is drawn in the same color as the dots, with a compass. The dots are used in *locating* the iris, rather than as a guide to size.

Size of the iris.—Iris diameters vary in diameter from 10.5 mm. to 12 mm. Size of the iris is determined by measuring the life-size photograph of the patient's orbital area. As an alternate method,

the patient's remaining iris can be compared with sample irises graduated in size and cemented to the edge of a strip of white paper. Holding a flexible rule near the remaining iris, at this stage is not sufficiently accurate, and use of micrometers, calipers, and so forth, near the remaining eye is discouraged because of their sharp points and edges. One-half millimeter should be deducted from the measured or estimated diameter to allow for later magnification by a clear acrylic cornea. With experience the operator will learn to estimate iris size without using photographs, stock irises, or other aids.

The restoration is reinserted in the patient's eye socket, and the location and size of the iris circle checked for accuracy, and changed if necessary.

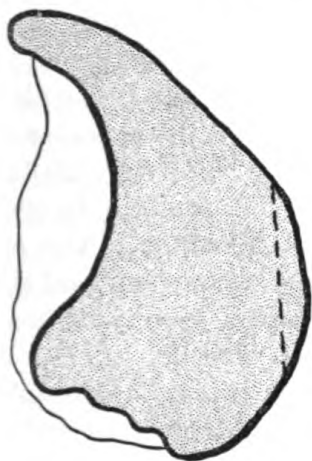
THE MASTER MOLD

Reinvesting the prosthesis.—In subsequent steps temporary changes will be made in the contour of the anterior portion of the prosthesis. A master mold is prepared, therefore, at this stage to preserve a record of the now-correct proportions, by investing the prosthesis in the modified Pryor-type injection flask as before.

Modifying the master mold.—After the prosthesis is removed from the flask, the circle representing the iris will be found printed on the mold in the upper section of the flask. The concavity of the stone inside this circle is accentuated by carving with a spoon-shaped scraper, to allow for an increase in bulk of the clear portion which will be added over the iris later. The purpose of the added bulk is to allow for later polishing and to permit final minor modifications if necessary in the anterior contours of the finished restoration.

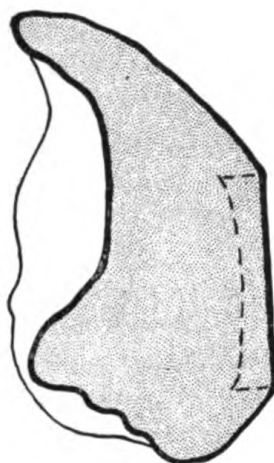
THE IRIS COUNTERSINK

The convex surface circumscribed on the prosthesis by the circle to indicate iris size and position is cut down flat (fig. 12a) with a mounted stone; care is taken to leave at least a trace of the circle intact. This flat area is then countersunk with an inverted cone mounted stone, and to a depth of only 1 mm. so that correction in location and size can be made if found necessary. The countersink diameter should be exactly the size previously determined upon for the iris. The countersink is now filled with pink base-plate wax, which is shaped to restore the contour present before flattening and countersinking. At the patient's next visit the prosthesis is inserted for rechecking the orientation and size of the iris. Any modification of the countersink should be made at this time. After the iris location is thus finally established, the prosthesis is taken out and all traces of wax removed. Then, with the prosthesis again *in situ*, and the patient's remaining eye in mid-line position, the planes of the



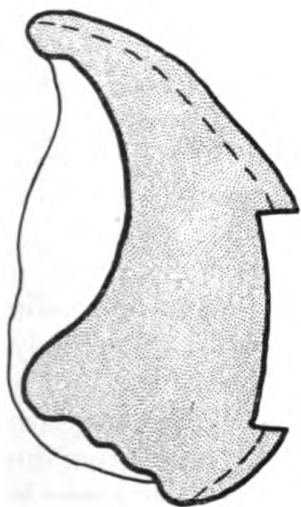
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FIGURE 12a.



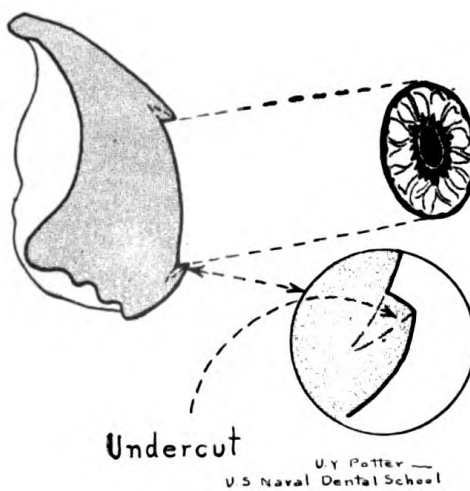
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FIGURE 12b.



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FIGURE 12c.



Undercut

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FIGURE 12d.

irises of both "eyes" are observed, from eye level at the side, and from below, for the purpose of determining what modifications in the countersink must be made to duplicate the "tilt" of the remaining iris. The prosthesis is removed. The countersink is deepened, and cut to the corrected iris floor plane, to a depth of 2 mm. (fig. 12b) at the shallowest point of its periphery. The floor is left slightly convex; undercutting the countersink is avoided at this stage. The remaining area of the anterior surface, between the countersink and the periphery of the prosthesis, is then reduced with a mounted stone approximately 1 mm., preserving, at the same time, as nearly as possible a hemispherical surface (fig. 12c). This will be more difficult in prostheses with irises which have an unusual degree of "tilt." The anterior surface of the prosthesis is left unpolished, for later addition of pigments.

Undercutting the countersink.—In the natural eye, the outer rim of the iris is a diffused rather than a sharp outline. To simulate this, the countersink, which is now 1 mm. in depth at its periphery, is undercut at an angle of approximately 30° (fig. 12d) and the undercut surfaces painted with grade blue-purple permanent water-color pigments.

THE IRIS—PAINTING AND FIXING THE PIGMENTS

Painting the iris.—Duplicating the colors of the iris is difficult for anyone who is not a trained artist. With the patient's remaining eye as a model, the iris is painted onto a disk of high-grade water color paper of the proper size. (The irises are cut with steel punches, sizes from 10.5 mm. to 12 mm. at 0.5 mm. intervals.) Select grade permanent water-color pigments are used for the colored portion of the iris; the pupil is drawn with waterproof black india ink.

Fixing the iris.—The painted iris is dried for 3 hours at 60° C. in a dry-heat oven. It is then removed and given a protective coating by dipping in a saturated solution of clear methyl methacrylate polymer in benzene. It is allowed to dry at room temperature for 15 minutes or longer, and again put in the dry-heat oven for one hour at 60° C. If the iris should need retouching at any time after this dipping and drying, the thin coating of methyl methacrylate may be peeled off, or the pigments may be added onto the coating and the iris recoated as before.

Adding scleral colors and blood vessels.—At the same time the patient's remaining eye is serving as a model for painting the iris, the scleral colors and blood vessels are painted onto the unpolished anterior surface of the prosthesis with permanent water colors prepared with a 1-percent aqueous solution of pure dioctyl sodium sulfosuccinate, as a carrying medium. The unfinished prosthesis is oven-dried for 1 hour.

Adding iris and protective cement.—The iris and prosthesis are removed from the oven and allowed to cool. The iris is firmly seated and cemented into the prepared countersink with an iris cement. The entire anterior pigmented surface, including the iris, is then coated with two layers of the iris cement. A first coat is applied and allowed to dry at room temperature for 15 minutes or longer; the second coat is then applied, and the prosthesis is again dried in the oven at 60° C. for 1 hour.

ADDING CLEAR METHYL METHACRYLATE

To complete the prosthesis the master mold is now tinfoiled, and the prosthesis is reinserted in the bottom section of the mold. Enough clear methyl methacrylate is mixed and packed in the upper half of the mold to almost but not quite fill the void created by reduction of the anterior surface of the prosthesis. The sprue channel is filled as before, and the cylinder again filled to within $\frac{5}{8}$ inch of the top, and the flask bolted. The spring-jack is applied, and flask set in the water bath and the rubber hoses connected to the coil, etc., and the prosthesis recured in the manner previously described. The completed prosthesis is removed from the flask and trimmed and polished as before.

THE PATIENT AND HIS PROSTHESIS

The prosthesis is inserted in the patient's eye socket, and he is instructed in its use and care. If he has not been wearing a prosthesis habitually, he is told to remove this one at intervals—once a day if necessary—for a month, to wash it under warm water with a soft cloth and face soap. During this first month he will learn the minimum frequency with which he must wash the prosthesis to maintain cleanliness.

DISCUSSION

Through use of the technique described the three goals of comfort, permanence, and esthetic adequacy have been achieved.

Comfort.—The individualized prosthesis is accurately adapted to the entire ocular cavity, without the irritating pressure points of a stock restoration. The acrylic eye has a low coefficient of thermal conduction. Unlike glass, it retains a high surface polish; it is not etched and roughened in the presence of lachrymal secretions.

Permanence.—The acrylic itself is practically indestructible, and non-fading pigments for iris and scleral portion are available. Mechanical scratches, and etching by organic solvents, can be removed by polishing.

Esthetics.—The unevenly distributed colors and shades, and the blood vessels, of the patient's remaining eye can be duplicated more

accurately in the acrylic eye than in one of glass. Acrylic also has a more natural-looking degree of fluorescence and reflection. Since the restoration is removable, two prostheses, one for daytime and one (with larger pupil) for nighttime use, can be provided. The principal esthetic gain, however, has been in mobility. Because of the complete and positive contact of the individually fitted prosthesis, there is a lifelike spontaneity and range of movement impossible to stock restorations.

CONCLUSION

Research at the U. S. Naval Dental School for improvements in the procedure, and comparison with and testing of other techniques is continuous. One of the present objectives, for example, is reduction in the number of patient visits required without sacrificing accuracy of iris orientation or of the natural appearance of palpebrae and surrounding tissues.

On the basis of several hundred eyes made at the Naval Dental School, and in view of the growing nonmilitary demand for an adequate prosthesis, it seems to the author to be increasingly important that there be a more active exchange between all those who are working for its improvement, and that more graduate dental schools teach and conduct research in the field of plastic ocular restorations.



"BEACH FOOT"

The author describes a treatment for "beach foot" or "athlete's foot" which has proven very successful in three cases, including himself, and which consists in the following: A strip of bandage, wet with methylated spirit is drawn between the toes and applied to outlying areas, "followed by another strip wet with petrol for its very efficient surface drying about three times a day for a week, then once or twice a week for a month. This gave complete cure, and I have had no further trouble. * * *

"Possibly absolute alcohol would be more effective than methylated spirit, but the latter is more easily obtainable and served the purpose."

The author wishes to know if there is an antiseptic power in petrol as he has used it for years for cuts and punctures by nails, splinters, etc. and has had no trouble and claims that it is painless.—POCKLEY, E.: "Beach foot." M. J. Australia 1: (No. 10) : 346, March 1946.

NOTES ON SPINAL ANESTHESIA FOR INTERNES USING PROCAINE OR NOVOCAINE

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Lieutenant Commander (MC) U. S. N.

The successful use of spinal anesthesia with procaine or novocaine depends in part on avoiding common difficulties. A method of administration frequently used is discussed in these notes.

Usual contra-indications of spinal anesthesia.—These are: (1) Surgery above the diaphragm; (2) shock or impending shock; (3) extreme weight loss, or cachexia as with carcinomatosis. In shock or cachexia the blood-pressure fall, often seen at the onset of spinal anesthesia, may be severe; (4) hypertension above 190 to 200 systolic, or hypotension of 80 to 90 systolic (hypertensive patients occasionally have a severe fall in pressure soon after spinal anesthesia is started); (5) skin lesion at the site of spinal puncture; and (6) history of chronic, low back pain is often considered a contraindication in view of possible postoperative functional pain, or true organic pathology present before operation.

Advantages of spinal anesthesia are: (1) Complete sensory and motor anesthesia; (2) ease of administration; and (3) less post-operative care.

Disadvantages of spinal anesthesia.—These are: (1) Blood pressure fall; (2) respiratory paralysis with excessively high anesthetic levels; (3) anesthetic level occasionally too low; (4) limited time for surgery unless continuous spinal anesthesia is used; (5) post-operative neurological complication; (6) apprehension of the patient; and (7) common occurrence of traction reflex pain from the viscera.

Administration of procaine or novocaine.—In this there must be considered: (1) The position of the patient; (2) the site of injection; (3) the volume of fluid injected; (4) the rate of injection; (5) the dosage; and (6) the size of the patient.

It is helpful to have as few variables as practical in the six items listed. The most commonly used position is that of the patient on his side, with the table level. It is advisable to elevate the head with a pillow as a precaution, as novocaine crystals in physiologic saline solution or spinal fluid make the anesthetic solution of greater density than the spinal fluid in the spinal canal.

The site of injection is relatively unimportant as long as the lumbar puncture is made at lumbar interspaces 2, 3, or 4.

The volume of anesthetic solution injected and the rate of injection, can be considered together. The greater the volume, the higher the anesthetic level; the faster the injection, the higher the level. A practical rule that eliminates variables is to use 3 cc. of spinal fluid in preparing a 150 mg. solution of novocaine. If this is injected at a rate of 0.5 cc. per second, or in 6 seconds time, the resultant levels for herniorrhaphy, appendectomy, or cholecystectomy mentioned in the next paragraph hold true. If one uses 100 mg., then the volume of the solution may be 2 cc., or for 75 mg., 1.5 cc. In this way the percentage of the novocaine solution being injected is not variable, always being 5 percent.

The dosage is an important variable. Seventy-five mg. is adequate for the genitalia, perineum, or rectum. Feet and legs require more, up to 100 mg. Herniorrhaphy, appendectomy, or cholecystectomy require 150 mg. The dosage is determined not only by the level of anesthesia desired, but also by the duration of the procedure to be done. Thus a 1½-hour procedure for the knee could be given 150 mg. Considering that the injected novocaine in spinal fluid or physiologic saline solution is heavier than spinal fluid alone, it is practical to tip the table head up—feet down a few degrees, if giving 150 mg. of novocaine for an arthrotomy of the knee. This results in the final anesthetic level at the umbilicus or below. Conversely one can tilt the table head down—feet up a few degrees after giving 150 mg. of novocaine for a cholecystectomy. This must be done cautiously however, and with the head propped up by a pillow. For an appendectomy, one can expect an anesthetic level somewhere between the umbilicus and xiphoid tip of the sternum when the table is flat throughout the procedure using 150 mg. dosage.

Care must be taken to consider the size of the patient in terms of his spinal-cord length, rather than his weight. This is a relatively unimportant variable and usually disregarded. With very tall patients however, one can logically increase the dosage. As much as 300 to 400 mg. of novocaine have been injected at once into the spinal canal without difficulty. However, 200 mg. is usually considered maximum dosage given at one time.

Complications.—These may be listed as follows:

(1) Respiratory complications. When the anesthetic level is high, the patient at first experiences dyspnea. However, until the phrenic nerve is paralyzed as its fibers leave the cervical cord, the diaphragmatic breathing prevents respiratory failure. A patient may experience dyspnea with the anesthetic level at thoracic segment two and three. As the level rises, he becomes unable to speak and soon unable

to breathe. Intravenous respiratory stimulants are of no value in this situation. Oxygen is needed and is best obtained from an oxygen tank, using a rubber bag and tight-fitting face mask to obtain positive pressure, simulating normal respiration. As the rubber bag is squeezed manually, elevation of the anterior chest indicates the pressure is adequate. Release of the bag allows for the oxygen to be exhaled due to the seeming elasticity of the paralyzed chest wall. Where one is of necessity without adequate equipment for such resuscitation, mouth to mouth breathing is effective. Compression of the patient's rib cage manually has been used to combat such respiratory paralysis. In all three methods of resuscitation the patient's chin must be elevated to facilitate an adequate airway. The paralysis of the phrenic nerve is usually of brief duration and following effective resuscitation, as described, the diaphragm again functions within a few minutes. In the absence of simultaneous circulatory collapse the patient usually suffers no ill effects from the respiratory paralysis if resuscitation is effective. The surgery can continue throughout the episode or be resumed when normal diaphragmatic function returns.

(2) Circulatory complications. It is advisable to give a vaso-constricting agent such as ephedrine (gr. $\frac{3}{4}$ to gr. 1) or neosynephrine (2.5 mg.) intramuscularly a few minutes before spinal anesthesia is started. This will help prevent blood-pressure fall which frequently occurs 5 to 10 minutes after the novocaine has been injected. If, however, blood-pressure fall is severe at this time, the ephedrine or neosynephrine can be repeated intravenously, in smaller dosage ephedrine gr. $\frac{1}{2}$ or neosynephrine 1 mg. At the same time intravenous fluid should be started. Dextrose-saline solution is most frequently used at this time because one is usually treating a transient fall in pressure. If a patient is given ephedrine or neosynephrine 10 minutes before the spinal puncture, and the blood pressure is 120/80, there may be no fall in pressure following injection of novocaine. If the pressure falls from 120 systolic to 80 systolic during a 10-minute period after injection of novocaine, the patient needs careful watching, and a second dosage of intramuscular ephedrine gr. $\frac{3}{4}$ or neosynephrine 2.5 mg. is indicated. Further drops in pressure calls for intravenous fluid, administered rapidly. If by the time the fluid is started intravenously, the systolic pressure is 50 or less, one can add ephedrine or neosynephrine intravenously through the intravenous tubing. When the fall of pressure has been even more precipitous, following the injection of novocaine, going as low as 40, 20, or zero systolic, it seems more logical to inject the vaso-constricting agent intravenously before starting the intravenous dextrose-saline solution.

As surgery progresses during a previously uneventful spinal anesthesia, a gradual blood-pressure fall and pulse rise may be observed.

This is seen in many surgical procedures regardless of anesthetic agent, and is due in part to unavoidable trauma and blood loss. This is the time to prevent severe surgical and anesthetic shock by starting intravenous fluids at once instead of waiting until shock has become apparent. More good can be done with relatively small quantities of blood, plasma, albumin or dextrose-saline solutions, used prophylactically against operative shock when signs first appear, than can be done with larger quantities of the same fluids 30 or 60 minutes later.

Fortunately, the respiratory and circulatory complications mentioned do not often occur at the same time. When they do, the treatment is not different than when occurring individually, but each must be treated at the same time.

(3) Occasionally the anesthetic level is not high enough, or the anesthesia does not last at the desired level longer than a few minutes. When surgery has not started and the anesthetic level is too low, one is tempted to repeat the spinal puncture. This should be done by those who have had considerable experience with spinal anesthesia. Clinically it is logical to give a second spinal anesthesia, considering the large consecutive dosages sometimes given when continuous spinal anesthesia is used. If one has given 150 mg. for an appendectomy and the level of anesthesia stops at the hips or pubis, it is well, in repeating the spinal tap, to give 50 mg., or less, for the additional dosage. If no anesthesia results from the original tap, a rough rule might be to give 100 mg. of novocaine with the second attempt. When the anesthesia fails after surgery has started, pentothal sodium is a good supplementary agent, in most cases. This is true in spite of the fact that pentothal is not particularly effective in relaxing muscles. It appears, in abdominal surgery, as if muscular relaxation continued after pain is first experienced.

(4) Much has been written about postoperative respiratory complications. An easy procedure that can be followed in most cases is to encourage coughing and deep breathing postoperatively. Other measures are useful, and required particularly when pneumonia or atelectasis has occurred. However, coughing and deep breathing are of prophylactic and therapeutic value.

(5) Neurological complications of spinal anesthesia can be possibly avoided in part by using care during the spinal puncture, by using a low concentration of the anesthetic solution to be injected, and by questioning the patient relative to previous experiences with spinal anesthesia. Recently a spinal anesthesia was not given because the patient volunteered that he required a urinary catheter for 6 days postoperatively following a herniorrhaphy 5 years previously.



PSYCHOMETRIC EXAMINATIONS ABOARD A DESTROYER

ALFRED M. BONGIOVANNI

Lieutenant (MC) U. S. N. R.

The psychometric measurement of recruits for service has been a problem for psychologists whose duty it is to eliminate those who might sooner or later prove unfit by reason of mental defect. The study reported in this article was undertaken aboard a destroyer, during the period 1944-45, in order to determine what percentage of those men on active service are mentally defective, as well as to note certain correlations of interest in this connection.

The Kent Oral Emergency Test, which first appeared in 1932 (1), has lent itself well to making these determinations. It is an individually administered oral test. The more recent revised test of ten 1-minute questions (2) has been used. Lewinski (3) reports its use on 300 naval recruits and makes certain suggestions as to details of administration; he reports high positive correlations with other well-known tests, both for the original and revised (4) Kent tests. While this test has the advantage of brevity and excellent correlation with other tests, Lewinski warns that where precise measurement of mental ability is desired, the Kent test should not be substituted for more extensive examinations.

The total complement of the destroyer on which the study was made, exclusive of officers was 298, 90 percent of whom have been submitted to this examination. The men examined were selected at random; they were examined at their leisure and informally. Those few cases, where the subject seemed unwilling or unduly emotional, have not been included. This group may well represent a cross section of the Navy assigned to this type of duty. The men were from all parts of the country; the ship operated actively in the eastern and western war theatres. The age range was from 17 to 42 years, with a mean chronological age of 23.4 years. The number of years of formal education per man varied from 2 to 16, with a mean of 10.1 years. The group consisted of regular Navy men, Naval Reserves, draftees, and enlistees.

Test scores of 90 or better were considered normal; those within the range 80 to 89, dull normal; those from 70 to 79, borderline; those below 70, mentally deficient.

Table 1 shows the scores for the entire ship. From this it is seen that 4 percent were mentally deficient by the Kent test. The low scores ranged from 58 to 69, practically all falling in the upper 60's. Neither clinically nor by test score, can any of the latter be considered as falling below the moron level.

TABLE 1.—*Classification of scores in Kent test*¹

Score classification	Number	Percent
Normal (90 or better)	181	69
Dull normal (80 to 90)	50	19
Borderline (70 to 79)	22	8
Mentally deficient (69 or below)	11	4
Total	264	100

¹ The range of the I. Q. for the entire ship was 57 to 103. The highest possible attainable score in the Kent revised test is 105. The average I. Q. was 91 and the mode 98.

TABLE 2.—*Comparison between psychometric scores and ratings of men taking test*

Rating	Number tested	Scores							
		Normal		Dull normal		Borderline		Mentally deficient	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Chief petty officer	14	14	100.0						
Petty officer, first class	24	22	91.7	2	8.3				
Petty officer, second class	40	35	87.5	3	7.5	2	5.0		
Petty officer, third class	66	47	71.2	12	18.2	2	3.0	5	7.6
Seaman, first class	68	43	63.2	15	22.0	8	11.8	2	3.0
Seaman, second class	51	20	39.2	18	35.3	9	17.6	4	7.8
Apprentice seaman	1					1	100.0		
Total	264	181	69.0	50	19.0	22	8.0	11	4.0

Table 2 shows a comparison between psychometric scores and the relative rating of the men. The ratings are indicated in descending order, chief petty officer being the highest and apprentice seaman the lowest. From this it is apparent that the scores become increasingly better with the higher rating. This is significant for 2 reasons. First, it indicates, as is expected, that those with superior mental endowment have advanced farther. Second, it speaks well for the system of advancement, in that the superior individuals have been elevated; this is particularly noted in the chief petty officer rating, where all were normal. It is to be added that because of the upper limits of the test, those above normal cannot be designated. It is interesting to note that 5 of the 11 mental defectives have reached the rating of petty officer, third class. Two are ship's cooks, 1 a ship's barber, 1 a radarman, and 1 a torpedoman. Clinically, 4 of the 5 were patently of inferior intelligence; in the instance of the radarman, the test grade (69) may be in error. With this single exception,

the division officers consulted in each case recognized the intellectual limitations of these petty officers; nevertheless each was deemed worthy of the rating and capable of performing his necessary duties to satisfaction. This fact is especially important, because it signifies that the mental defective does have a place in the service, provided his deficiency is not marked. He is often well suited to certain types of duty which do not gratify the normal or superior intellect. It is important to recognize the mental defective, however, "to guard him from circumstances and situations with which he is not intellectually able to cope" (5) and to assign him to circumscribed activities. With these restrictions in mind, from actual observation of these men, it is believed that if a large post-war Navy is to be maintained, these individuals need not be eliminated; nonetheless it is important that they be recognized.

TABLE 3.—*Comparison of scores between Navy and Naval Reserve personnel*

Class of personnel	Num- ber tested	Scores							
		Normal		Dull normal		Borderline		Mentally defi- cient	
		Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Regular Navy.....	54	46	85.2	5	9.3	2	3.7	1	1.8
Naval Reserve.....	210	135	64.3	45	21.4	20	9.5	10	4.8
Total.....	264	181	69.0	50	19.0	22	8.0	11	4.0

Table 3 shows a comparison of scores between regular Navy and Naval Reserve personnel. Ten of the 11 deficient scores were among the reserves; 20 of the 22 borderline scores were also among the reserves. While the series is not particularly large, the fact that the regular Navy man, in this group, has been in the service for a considerable period of time and entered the service when careful screening for intelligence was practiced, must be considered.

TABLE 4.—*Comparison of scores between draftees and enlistees*

Class of personnel	Num- ber tested	Scores							
		Normal		Dull normal		Borderline		Mentally deficient	
		Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Draftees.....	97	54	55.7	25	25.8	10	10.3	8	8.2
Enlistees.....	167	127	76.0	25	15.0	12	7.2	3	1.8
Total.....	264	181	69.0	50	19.0	22	8.0	11	4.0

Table 4 shows a comparison between draftees and enlistees. Eight of the mental defectives were draftees. While the remaining differences are not striking, it appears that the enlistee is slightly superior. Here again, the enlistee includes the regular Navy man who entered at a time of more particular selection.

Table 5 shows the correlation between I. Q. and years of service. There is a progressive rise with a longer term of service. For the greater part, those of longer service are also those of higher rating; hence this tabulation may be compared with table 2. Of those with 6 or more years' service, one is dull normal; this one has not advanced beyond the rate of petty officer, third class. While the details have not been tabulated, it was generally noted that those of less than normal I. Q. advanced more slowly.

It was considered that those with more than 3 years' service should have attained at least the rate of petty officer, third class. Eleven were found who, although having served more than 3 years, had not attained this level. Eight were normal and three dull normal, according to the Kent test. Of the normals, three had had various courts-martial for major offenses; one had been hospitalized twice for hysteria, and one has since advanced in rating. Of the dull normals, one has an inadequate personality and a gastric neurosis.

TABLE 5.—*Correlation between I. Q. and years of service*

Years of service	Number tested	Scores							
		Normal		Dull normal		Borderline		Mentally deficient	
		Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent
1 or less	49	27	55.1	10	20.4	9	18.4	3	6.1
1 to 3	159	108	67.9	34	21.4	10	6.3	7	4.4
3 to 6	45	36	80.0	5	11.1	3	6.7	1	2.2
More than 6	11	10	91.0	1	9.0				
Total	264	181	69.0	50	19.0	22	8.0	11	4.0

The disciplinary status of each man was also reviewed, and 22 who had had 1 summary court-martial or worse were found. Of these, 10 were normal, 7 were dull normal, 3 were borderline, and 2 were mentally deficient. Of the total number, 5 had had 2 general courts-martial; of these 2 were mentally deficient, 2 borderline, and 1 normal. Inspection of the Captain's Mast log indicated that the great majority of petty offenders were normal. In general, disorders of personality are accountable for offenses in the service, as is borne out by a recent analysis by Bromberg et al. (6).

COMMENT

The division officers aboard the vessel took an active interest in this study. Some have selected prospective petty officers as novices on the basis of these scores. This has been particularly valuable where a position of greater responsibility is to be filled, and where satisfactory and efficient response to rapid training is desired. Such a criterion, if generally applied, should result in minimal loss of time and expense and maximum productivity of the armed forces. In time of war, these are important considerations.

Those men of normal I. Q. by the Kent test, who have advanced little, or not at all, over a period of time, were investigated with the hope of giving them proper recognition and more appropriate duties, provided their personalities were adequate.

As Lewinski has pointed out (5), the mentally deficient can be utilized in a military setting; this has been borne out by practical observation on this vessel. This fact does not minimize the importance of classifying these individuals and restricting them to assignments which will not too heavily tax their limitations.

CONCLUSIONS

1. Psychometric measurements of a Navy group aboard a destroyer, in time of war, by the Kent Oral Emergency Test have been presented.
2. Four percent mental defectives have been reported, none being marked in degree.
3. Mentally deficient enlisted men seem to have a place in the Navy; they are to be limited to restricted detail.
4. Greater advancement was apparent among those of relatively higher I. Q.
5. Psychometric measurements for enlisted men may be of value in properly placing these men, assigning them duties in accordance with their scores. This should lead to greater efficiency and in times when rapid learning is so essential with regard to the operation of new and complicated equipment, such measurements would prove to be of practical value.
6. The Kent Oral Emergency Test lends itself well to this purpose.

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USE OF PAPAVERINE HYDROCHLORIDE IN PREVENTION OF ANAPHYLACTIC SHOCK IN GUINEA PIGS

"The relaxation of smooth muscle and bronchial dilatation by the action of papaverine suggested its use as an antagonist to histamine. In guinea pigs papaverine, intraven., causes a marked increase in respiratory and cardiac rates, proportional to the size of dose. The action begins to subside in 5-15 min. depending on size of dose. In controls, 0.045 mg./100 g. wt. of histamine, intraven., was found an effective and decisive minimal dose producing 100% fatality from shock. In 20 guinea pigs, pretreated at varying time intervals with papaverine, with doses from 1 mg. to 7.28 mg. histamine in the above dose proved 100% fatal. In 30 guinea pigs sensitized to horse serum, and pretreated with papaverine intraven. at varying intervals before the shock dose, with doses of 0.46 mg. to 2.91 mg., 53% of the animals survived, although all displayed some degree of anaphylactic shock. Thus union of antigen and antigen was apparently not prevented by papaverine. In the histamine shock cases, it is assumed papaverine failed in its antagonistic role because conc. of histamine was much greater at site of shock organs than during anaphylaxis. A discussion of several other methods of histamine antagonism is given. Papaverine is not considered a very effective antagonist."—FRANK, D. E.: The Use of papaverine hydrochloride in the prevention of anaphylactic shock in guinea pigs. *Jour. Immunol., Virus-Res. and Exptl. Chemother.* **52**: 59-64, Jan. 1946. *Biol. Abstr.* **20**: 940, May 1946.

THE LABORATORY DIAGNOSIS OF DIPHTHERIA ¹

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There have been several small outbreaks of faucial and cutaneous diphtheria during World War II. One of the largest outbreaks (previously unreported in the literature) consisting of a total of 50 cases with 1 death, occurred in the Second Marine Division shortly after the close of the Saipan campaign (1). It goes without saying that diphtheria is more prevalent in wartime, and although it is not expected to be one of the greatest problems of the postwar naval medical department, it will undoubtedly occur. Impressive statements are found in current literature referable to diphtheria in armed forces: "All military personnel should be actively immunized against this disease" (2); "Pharyngeal diphtheria has become increasingly important in the U. S. zone of occupation in Germany since the termination of hostilities" (3); and "There is a greater likelihood of finding diphtheria in the tropics than in the United States" (4). In view of the potential hazards of diphtheria in the widely dispersed naval personnel, it behooves every laboratory capable of doing any work in bacteriology to be cognizant of the latest techniques in the laboratory diagnosis of this disease.

While it is the opinion of many that acute diphtheria is a clinical diagnosis and little can be offered by the laboratory (5) (6), it is felt that in many cases the laboratory can be of help. Certainly for epidemiological reasons it should confirm the diagnosis in acute cases, and completely identify the organisms in carriers, contacts, and in cutaneous cases. In reviewing reports of diphtheria studies, one is impressed by the dearth of information concerning the laboratory diagnosis. Too many epidemics have been studied purely by the time-worn Loeffler slant which has been proved by many (7) (8) (9) in recent years to be less accurate than the various tellurite media. It is the purpose then of this article to explain the capabilities of the laboratory in the diagnosis of diphtheria and to popularize some of

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the newer well-established diagnostic methods. An appraisal of the procedures for laboratory diagnosis can best be made by considering them in the order utilized for diagnosis.

DIRECT SMEAR

The direct throat smear is usually deprecated in more recent literature (10) (11) (12), and this seems particularly justified when technicians are inexperienced in the diagnosis of this disease. If a patient has the clinical symptoms of diphtheria with a membrane, the clinician should not rely on the report from a direct smear in determining treatment. Although the laboratory may offer valuable assistance in 18 to 24 hours, the clinician must decide on the treatment in the acute case.

Methylene blue is the stain of choice for routine work, although granule stains are popular. From throat smears and Loeffler cultures, granule stains may lead to false-positive errors with the inexperienced since other bacteria will also demonstrate granules. The intermedius strain which is fairly common in some sections rarely demonstrates granules, making for false-negative diagnosis. Therefore granule stains (Beck's, Neisser's, etc.) are not recommended for routine diagnosis, especially when the personnel have little experience with *Corynebacterium diphtheriae*.

LOEFFLER SLANT

The use of Loeffler's medium for the laboratory diagnosis of diphtheria is still popular and is valuable, although it has many undesirable features. This procedure, based on the microscopic examination of a stained smear from the culture, is as subjective as the clinical diagnosis and depends largely on a visual image interpreted in the light of past experience. The technician is obliged to examine a stained smear from the emulsified surface growth of every slant preferably in 18 to 24 hours. This is particularly time-consuming in the case of surveys, and when diphtheria organisms are few in number the diagnosis is very difficult. Furthermore, this medium is not simple to prepare and the morphology varies with almost every batch depending upon the pH. Dehydrated Loeffler's medium has been found fully as satisfactory as fresh serum Loeffler's and gives a more uniform morphology.

In the autoclaving of this medium, most success has been achieved in this laboratory by wrapping the baskets in paper, closing off all exhausts, running the pressure up to 20 pounds as quickly as possible, keeping it at this pressure 1 hour, then turning off the steam and letting the pressure return to zero. This should be done without cracking the exhausts at any time in the process. This medium still

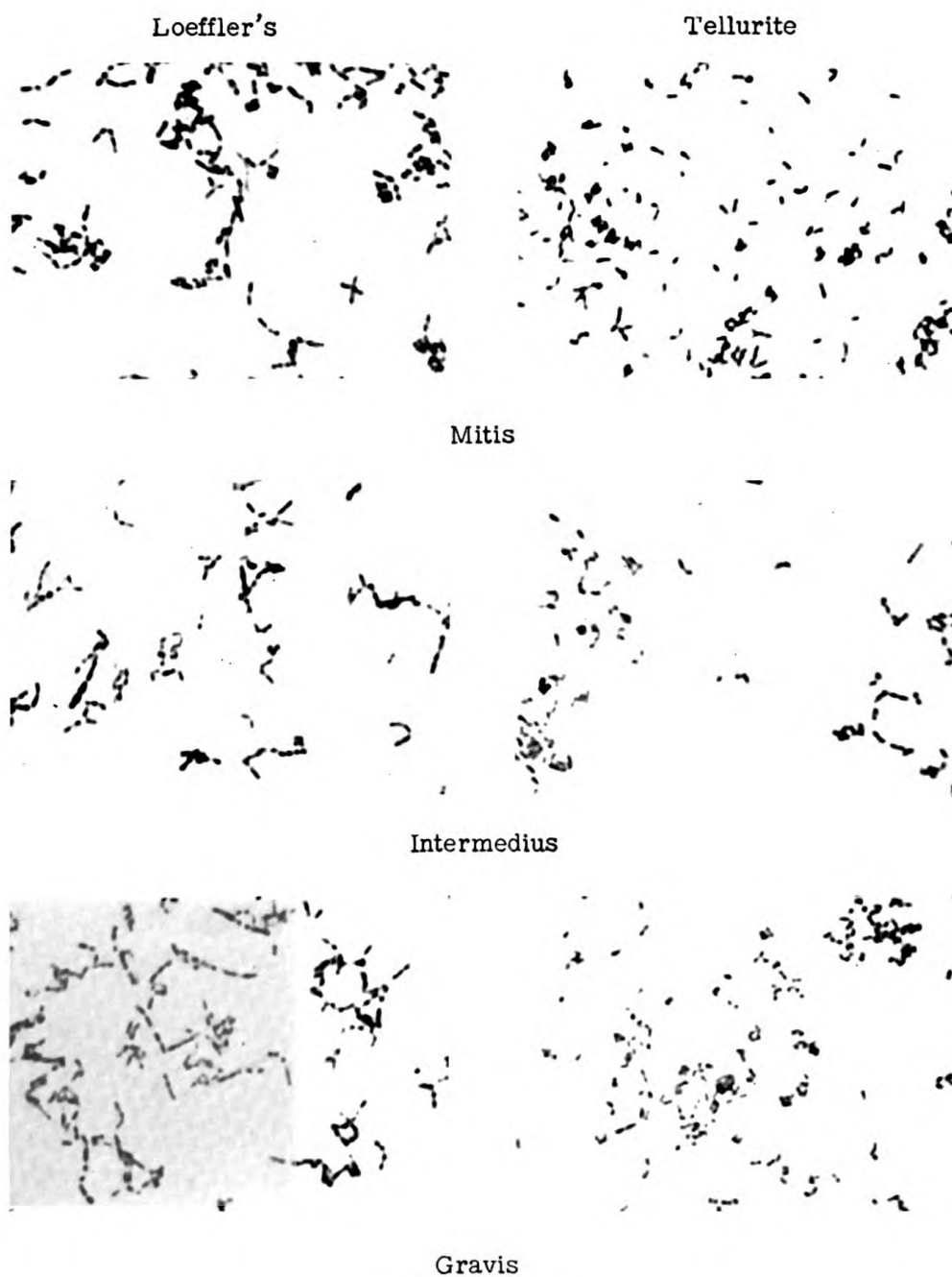
enjoys popularity for the rapidity with which the diagnosis can be made, and the so-called typical Loeffler morphology.

TELLURITE MEDIA

Potassium tellurite, when incorporated in various bacterial media, is reduced readily by *Corynebacterium diphtheriae* producing gray or black colonies which facilitates the detection of this organism. It also is inhibitive to the growth of other bacteria which tends towards pure cultures of *C. diphtheriae* in positive cases and little growth in negative cases. Only a few other organisms have the ability to reduce this chemical thus producing gray or black colonies which need be ruled out by morphological study. With a little experience the accuracy of colony fishing increases greatly, and pure cultures of possible diphtheria bacilli may be readily attained.

Numerous reports can be found comparing Loeffler's and tellurite media for the detection of *C. diphtheriae* with evidence in favor of tellurite (7) (8) (9) (10). Two of the principal arguments against tellurite media have been that growth is slowed and morphology of the *C. diphtheriae* is altered so as to make morphological diagnosis difficult until a culture is transplanted to Loeffler's medium. With the trypticase tellurite medium (to be discussed), growth of all three types of *C. diphtheriae*—*gravis*, *intermedius*, or *mitis*—can usually be detected in 18 to 24 hours which compares favorably with Loeffler's and morphology is not altered beyond recognition. As a comparison photomicrographs were made of 24-hour pure cultures of each of the three types of *C. diphtheriae* from both Loeffler's and trypticase tellurite media (see fig. 1). The alteration of morphology on tellurite medium varies but these changes were the maximal seen with the three types of *C. diphtheriae*. The change in morphology is greatest with the *gravis* strain which is rarest in the United States. It is believed that the change in morphology produced by the tellurite media is not inconsistent with the recognition of the organisms as corynebacterium. Mueller (10) has even suggested that the morphology from tellurite medium could become the typical morphology with experience.

There are numerous formulae utilizing potassium tellurite, and as many different concentrations used, dating from 1918 (13) to 1946 (10). European workers have been particularly concerned with altering the blood to be added and have demonstrated deleterious effects on the growth of *C. diphtheriae* from heated blood (14) (15) (16). Mueller (10), who has done the latest and most extensive work on culture medium for diphtheria, has developed a tellurite medium utilizing serum, proteins, and several additional substances. It is



24-hour incubation
Methylene Blue Stain, Magnification 1300X

FIGURE 1.—Comparison of the three types of virulent *C. diphtheriae* on Loeffler's and trypticase tellurite media.

too complicated for preparation in the routine laboratory and the *intermedius* strains are difficult to detect early. He demonstrated that cystine in added amounts when used in conjunction with tellurite was actually inhibitive to *C. diphtheriae*, so its addition should be discontinued. Cohen et al. (17) have shown that *C. diphtheriae* demands two growth factors, one of which is found in serum, not red cells. The other factor is furnished by casein or milk. The casein factor can probably be supplied by a number of protein substances.

A recommended medium (18) which is simple to make up consists of:

Trypticase ²	20 Gm.
Sodium chloride.....	5 Gm.
Dextrose.....	2 Gm.
Agar	20 Gm.
Distilled water.....	1,000 ml.

Adjust these ingredients to pH 7.4 to 7.6 and autoclave at 15 pounds for 15 minutes. When cooled to about 50° C., add the following and pour into plates:

Potassium tellurite, sterile, 1 percent.....	10 ml.
Serum, sterile.....	50 ml.

This modified Douglas medium has had a carefully studied trial of over a year in a very active state public health laboratory. It has been found the most satisfactory of the tellurite media in demonstrating in 24 hours the *intermedius* strain which forms the smallest colonies of the three types. This medium was found best in our laboratory after testing several, including Mueller's new preparation.

Some writers recommend a concentration of about 1:2,500 potassium tellurite (8) (14) (16) while others use 1:10,000 (10) (13) (18). The greater the concentration the slower will be the growth of *C. diphtheriae* and the greater the inhibition of other organisms. The trypticase tellurite medium which contains the lower concentration of tellurite is recommended, even though it may require more experience, because it will allow earlier diagnosis and there is less chance of inhibiting certain strains of *C. diphtheriae*.

On this medium organisms produce colonies with dark gray raised centers and lighter peripheral zones. In 18 to 24 hours the size varies from about 0.5 to 2.5 mm., the *gravis* being largest and *intermedius* smallest. Later the *gravis* take on the typical rough appearance. On the more concentrated medium using whole blood, *C. diphtheriae* colonies are quite black in 48 hours with a narrow, lighter peripheral zone. Contaminating organisms which also produce dark colonies are usually staphylococci, diphtheroids, and micrococci. Until experience is gained, all gray or black colonies with light peripheries must be checked morphologically and those resembling *C. diphtheriae* should

² Available commercially.

be studied further. It is felt that using clear tellurite medium made with serum instead of whole blood allows much better colony study. It is highly recommended that a hand lens be used in studying colony morphology.

BIOCHEMICAL REACTIONS

Many times the question will arise as to whether a morphologically typical organism is actually a virulent *C. diphtheriae*, and also what type it may be. This opens up a lengthy controversy since few diphtheriologists agree on the criteria for the types *gravis*, *intermedius*, and *mitis*. Frobisher (19) has given convincing evidence of the poor correlation between the clinical picture and the type, and has pointed out the numerous sets of criteria used by different workers for typing diphtheria organisms. For accuracy in comparing epidemiological studies standard criteria are a necessity. It would seem that since Anderson et al. (8) described these types, their criteria should be used in typing *C. diphtheriae*, as pointed out by Frobisher. They are described as follows:

Criteria for typing diphtheria organisms
[Intermediate strains are called *intermedius*]

Test	Reaction by type	
	Gravis	Mitis
Fermentation of starch.....	Positive.....	Negative.
Fermentation of glycogen.....	Positive.....	Negative.
Colony.....	Rough.....	Smooth.
Hemolysin in broth.....	Negative.....	Positive.
Final pH in broth.....	7.5 or above.....	7.4 or below.
Growth in broth.....	Granular.....	Even turbidity.
Pellicle.....	Positive.....	Negative.

Except to the epidemiologist, it is of little value to know the type of *C. diphtheriae* implicated, but it may be necessary to distinguish biochemically *C. diphtheriae* from diphtheroids when virulence tests are not practical. The fermentation of glucose and sucrose is quite adequate since with few exceptions *C. diphtheriae* ferments glucose but not sucrose. Diphtheroids, on the other hand, ferment both glucose and sucrose or neither. These 1-percent sugars are best prepared by autoclaving 10-percent solutions of the sugars separately, then adding them to nutrient broth containing 5-percent serum and brom-cresol purple indicator. These fermentations are not recommended for screening organisms for virulence tests, but rather in the place of virulence tests if they cannot be performed (3). They will usually identify an organism as *C. diphtheriae* although, according to Frobisher (20), a few will be avirulent and some virulent *C. diphtheriae* will give atypical fermentations.

VIRULENCE TESTS

Virulence tests are indicated particularly on organisms morphologically *C. diphtheriae* isolated from carriers, contacts, and cutaneous ulcers. From the acute clinical case in which a typical organism is isolated, it hardly seems necessary to prove its virulence except if indicated epidemiologically.

Virulence studies should be done more frequently, and probably would be if laboratory animals were more easily procured and cared for. The rabbit or guinea pig is usually used and the single animal intracutaneous method where a second injection of organisms follows antitoxin administration is recommended. Frobisher et al. (21) have extensively studied the use of chicks for virulence tests and have found them equally satisfactory to rabbits, sickness and death usually occurring in 3 days. They are cheaper, easier to handle, and require less space. Chicks 7 to 20 days old were specified, but later studies indicate that older chicks (at least up to 8 weeks) are satisfactory (22). The injection of 2 cc. (up to 5 cc. in older chicks) of a 48-hour broth culture is made subcutaneously over the attachment of the right wing. Controls are produced by injecting 1 to 3 hours previously 500 units of diphtheria antitoxin in the same site that is to be used later for injection of organisms. It is felt that in many cases chicks can be procured when guinea pigs or rabbits are not available, and chicks have the advantage of being easily injected by one person.

PROCEDURE FOR LABORATORY DIAGNOSIS

Laboratory procedures for the detection of *C. diphtheriae* depend on the situation. In general this will be either one of acute disease or carriers, contacts, and cutaneous cases which allow more time for laboratory diagnosis.

ACUTE CASES

1. Inoculate a tellurite plate, blood agar plate, and Loeffler's slant with a swab or loop. (This should be taken by the medical officer from beneath the membrane, if possible.) Observe the blood plate for evidence of hemolytic streptococci and the tellurite plate for typical colonies in from 18 to 24 hours. When suspected colonies of *C. diphtheriae* are found, make methylene blue stains from a colony and the emulsified surface of the Loeffler slant. Report the presence of organisms morphologically typical of *C. diphtheriae*. The blood plate will rule out streptococcal infections which may be confused or occur simultaneously. Hold the tellurite plate 48 hours before discarding as negative.

2. Prove virulence of the organism only when special indication exists.

NON-ACUTE CASES

1. Proceed as in No. 1 for acute cases, omitting the blood plate.
2. When a suspected organism is found, isolate in pure culture, grow in broth, and proceed with one of the virulence tests. When virulence tests cannot be done—
3. Inoculate the organism into the sugars, glucose and sucrose. Fermentation of glucose but not sucrose indicates *C. diphtheriae*. They should be held 1 week unless acid is produced earlier.
4. Type the organism biochemically according to the criteria of Anderson et al., only in special studies.

SUMMARY

1. An effort is made to critically analyze the methods used for the laboratory diagnosis of diphtheria.
2. A new, well-tried tellurite medium is introduced and the chick virulence test is emphasized.
3. Actual photomicrographs are presented to compare the morphology of virulent strains of the three types of *C. diphtheriae* on Loeffler's and a tellurite medium.
4. Procedures for the detection of *C. diphtheriae* in both the acute and nonacute situations are presented.

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ANTIVITAMINS FOR PANTOTHENIC ACID

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DIABETES MELLITUS IN A NAVAL HOSPITAL

Review of Fifty Consecutive Cases

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During the past year 50 diabetic patients were admitted to the U. S. Naval Hospital, Oakland, California. At first glance this would appear to be a rather low incidence, since during this same period more than 50,000 admissions were recorded. Yet it must be remembered that all known diabetics and many previously unsuspected cases were eliminated at the time of induction or enlistment. In Massachusetts, for example, 5 of every 1,000 selectees were rejected because of proven diabetes (1), an amazingly high incidence for young males, and more than 4 times that expected on the basis of the National Health Survey of 1935-36. In addition the majority of patients had relatively short periods of service, usually less than 3 years, and in some instances only a few months prior to the onset of their disease.

Of the 50 cases 27 were under 30 years of age and only 5 were over 40. It will be seen that a great majority of the cases are youthful diabetics, in whom the disease is usually characterized by (a) abrupt onset, (b) the presence of symptoms, (c) a relatively severe type of diabetes usually requiring insulin, and (d) insulin sensitivity, with a tendency toward hypoglycemic reactions.

On reviewing the mode of onset it was found that most cases could definitely date the onset of their symptoms. Only nine cases were revealed by routine urine analysis either for reporting a physical examination on Navmed Form Y or for unrelated medical procedures. In three the urine was examined because of recurring boils, or slow healing of cuts. Diabetic coma developing within 24 hours was the first evidence of the disease in one case. The remainder all had symptoms suggesting the correct diagnosis. In the order of frequency these were polyuria, weight loss, thirst, fatigue, and increased appetite.

Two symptoms which are less commonly thought of in diabetes were present sufficiently often in this series to be deserving of comment; visual disturbances, chiefly blurring of vision in 10 cases, and crampy pains in the lower legs in 11 cases. The visual disturbances were not due to diabetic retinitis as the fundus was normal in all cases. They were

attributed to osmotic changes in the refracting media due to fluctuation of the blood sugar level. In some cases the refractive error varied as much as 2 diopters on successive days. This is a point of practical importance to ophthalmologists, since correction of vision with glasses is unsuccessful until the blood sugar level is stabilized. The cramps in the feet and legs were not due to vascular disease, as the arterial pulsations were normal in all cases, but were attributed to mild diabetic neuritis, although there was no objective evidence of motor or sensory impairment, and the neurological examination was negative. They cleared promptly on the control of diabetes without any special therapy for the neuritis itself. In the classification of diabetic neuritis proposed by Treusch (2) these cases are identical with his group 1, Diabetes With Pain, characterized by: (a) Aching pains with cramps and tenderness; (b) legs affected especially; (c) pain worse at night; (d) no definite objective neurologic signs, other than tenderness; (e) diabetes out of control, and (f) prompt relief with control of diabetes. Only 1 case of true diabetic polyneuritis was seen.

Case 1.—A 34-year-old lieutenant, was admitted 24 March 1945 complaining of thirst, polyuria, craving for salt, increased appetite with loss of 35 pounds in the past 3 months, and severe crampy pains in the lower limbs. Examination revealed marked undernutrition, dental caries, absence of reflexes in the lower extremities, and tenderness of the legs and feet on squeezing. The fasting blood sugar was 365 mg. percent. On a diet of 300 grams of carbohydrate and 3,000 calories with 40 units of regular and 30 units of protamine zinc insulin daily, hyperglycemia and glycosuria were controlled, and he gained weight. The dental caries was corrected, and he was placed on a program of extensive physiotherapy and massive doses of vitamin B. Very little improvement was noted. On 9 July 1945 a lumbar paravertebral sympathetic block was performed with procaine, with only temporary improvement in his pains and paresthesias. At the time of his retirement 13 September 1945 there was little change in the pains in the legs, and the deep tendon reflexes were absent.

The marked and prompt improvement in the first group of cases is in sharp contrast to the refractoriness noted when there was objective evidence of involvement of the nervous system.

Of the known factors predisposing to diabetes, heredity and obesity are the most important, the former in the younger age group, the latter in the group past 40. In this series a family history of diabetes was present in 23 percent, a figure which is in close agreement with the generally accepted incidence. The expected incidence in non-diabetic patients is 2.8 percent. Blotner and Hyde (3) dealing with a similar age group found 32 percent among diabetics, 5.2 percent among nondiabetics. Because in most of these patients the diabetes was of only a few months' duration, a negative family history meant only that the patient did not know of any diabetes in his relatives. Since the relatives were not carefully examined to rule out diabetes,

and in many cases with advancing age the relatives will develop diabetes, the overwhelming importance of heredity in youthful diabetes is clearly apparent.

In only two instances was obesity noted. Both patients were past 40, both were detected on routine urine examinations, and had no symptoms related to diabetes. In both instances a low-caloric diet caused the disappearance of glycosuria and hyperglycemia, and insulin was not required. The contrast between these two types of diabetes, the insidious onset of a mild diabetes in obese individuals past 40, and the abrupt onset of a severe diabetes in younger individuals, is quite marked. All of those giving a history of abrupt onset were carefully questioned as to any precipitating factors, such as trauma, excessive fatigue, nervous strain, or preceding infections. None were found. This is in accord with Joslin's (4) expressed belief that there is no evidence that trauma or nervous strain produce permanent diabetes, although they may cause a transient glycosuria.

The cause of diabetes remains unknown, but recent experimental work has opened up a new field of exploration which holds great promise. Until recently experimental diabetes could be produced in two ways, by surgical removal of the pancreas, which was the original experiment of von Mering and Minkowski in 1899, or by repeated injection of anterior pituitary extracts, which damage the islet cells, introduced by Young (5) (6) (7) in 1937. However, in 1943 Dunn (8) demonstrated that the intravenous injection of alloxan, which chemically is the ureide of oxalic acid, and closely related to many normal intermediary metabolites, results in a rapid and selective necrosis of the beta cells of the islands of Langerhans, and produces permanent diabetes in experimental animals. It would certainly appear possible that a similar mechanism might explain the acute onset of diabetes in humans.

The diagnosis of diabetes is based on the demonstration of glycosuria, hyperglycemia, and impaired glucose tolerance. Glycosuria was present or had been present at some time in all cases. The fasting blood sugar ranged from normal to 365 mg. percent. A fasting blood sugar over 130 mg. is diagnostic of diabetes and confirmation by a glucose-tolerance test is not necessary. However, glucose-tolerance tests were usually performed as they furnish objective evidence of the type desirable in medical surveys, because they offer a basis for comparison of the effects of treatment on carbohydrate tolerance and because, particularly in older individuals, it is desirable to know the renal threshold for glucose.

The glucose-tolerance test used at this hospital during the period covered by this report was the one-hour, two-dose, or *Exton-Rose* test. The interpretation of this test differs considerably from the standard one-dose test, and is based on the fact that in the normal

individual the rise of the blood sugar curve following a second dose of glucose is lower than that following the first, or priming dose. This is known as the Hamman-Hirschman effect, or Staub-Traugott phenomenon. In the normal Exton-Rose test the blood sugar at the end of 1 hour is the same or below the level at the end of the half hour, and in any case not over 158 mg. percent. In the standard test the essential criterion is the return of the blood sugar to normal at the end of the second hour. As a rule the two tests agree but in doubtful cases we have used both methods, and obtained a normal result with the one-dose test, but an abnormal Exton-Rose test. In the experience of Magath, of the Mayo Clinic, the level of the blood sugar at 1 hour in the two-dose test gives the highest correlation (95 to 98 percent) of any single laboratory test for diabetes. However, the recent report of Langner, Romansky, and Robin (16) casts considerable doubt on the validity of the physiological hypothesis upon which the Exton-Rose test is based, and for the present the question must be regarded as unsettled.

When the fasting blood sugar is normal the glucose-tolerance test is essential for the diagnosis, because it will eliminate cases of renal glycosuria with a lowered renal threshold for glucose. Only one case of renal glycosuria was found.

Case 2.—A 38-year-old pharmacist's mate was admitted on his ship complaining of nervousness and pain in the right lumbar area. His father had diabetes. Glycosuria was found repeatedly. Fasting blood sugars were normal. The blood sugars in the two-dose test were: Fasting 98 mg. percent, $\frac{1}{2}$ hour 150 mg. percent, 1 hour 150 mg. percent. All urines contained sugar. A standard one-dose test with 100 grams of glucose showed: Fasting 83 mg. percent, $\frac{1}{2}$ hour 131 mg. percent, 1 hour 166 mg. percent, 2 hours 98 mg. percent, 3 hours 79 mg. percent. The fasting and $\frac{1}{2}$ hour urines were sugar free, all other specimens showed 4 plus sugar.

It will be noted that in the sugar-tolerance tests the blood sugar never rose above 166 mg. percent, and that glycosuria was present throughout the test. Under these circumstances tests should have been carried out to determine the nature of the reducing substance in the urine particularly in view of the family history of "diabetes," since it is only in this way that rare cases of pentosuria can be distinguished. It might be well to emphasize that there is no basis for the belief that renal glycosuria leads to diabetes mellitus. There is no relation between these two diseases, though they may occur in the same individual and thus complicate treatment. The apparent association in some cases is due to error in the original diagnosis of renal glycosuria. The two are readily differentiated by the glucose-tolerance test.

There are two precautions which are necessary in interpreting a glucose-tolerance test. First, the diet must have been adequate in carbohydrate for at least 3 days prior to the test, because fasting or

carbohydrate restriction can produce an abnormal curve. Second, in the presence of infection, the glucose-tolerance test is not dependable. This is well illustrated by the following case:

Case 3.—A 37-year-old coxswain injured his shin overseas sustaining what apparently was a contusion to the left tibia. He was admitted to the hospital, where urinalysis showed the presence of sugar. A glucose-tolerance test was done, and was characteristic of diabetes. The results were recorded in his health record and he was transferred to the United States as a diabetic. On admission here he had no glycosuria, and repeated fasting blood sugars and sugar-tolerance tests were entirely normal. X-ray of the tibia revealed an old healed area of osteomyelitis.

The diagnosis of diabetes in this case, based on glycosuria, hyperglycemia, and an abnormal sugar-tolerance curve seemed well established, yet subsequent events proved the diagnosis was wrong, and that the infection present at the time was the true cause of the impaired sugar tolerance. For this reason Joslin recommends recording of the temperature before and after each glucose-tolerance test.

In the management of diabetes, there are three general plans followed in America today. One is the restriction of diet and maintenance of under-nutrition, in order to avoid the use of insulin entirely, or to keep the dose as small as possible. This is a hold-over from the preinsulin era, is satisfactory in the older, mild, obese diabetic, but not well adapted to youthful diabetics, and has generally been succeeded by the plan of giving an adequate well-balanced diet, approximating the normal diet, and giving enough insulin to control glycosuria and hyperglycemia. A third plan advocated by Tolstoi (10) in New York consists merely of giving enough insulin to avoid ketosis, relieve symptoms, and maintain nutrition, completely ignoring hyperglycemia and glycosuria. Tolstoi maintains that there has never been any proof that glycosuria and hyperglycemia are in themselves harmful, and that his patients get along just as well as those treated by either of the other methods.

In general the second program was followed here, and for the following reasons:

1. In health Nature regulates the blood sugar within quite narrow limits, by an elaborate mechanism. Presumably there is a reason for this careful control.

2. Complications are seen much more frequently in neglected diabetics than in those carefully controlled.

3. Great improvement in carbohydrate tolerance takes place with proper treatment, so that patients originally requiring large doses of insulin ultimately need little or none.

4. By giving adequate therapy with insulin it has been possible to prevent the development of experimental diabetes from pituitary injections (11).

In this hospital the four standardized diabetic diets are as follows:

Diet No. 1.—105 grams of carbohydrates, 65 grams protein, 50 grams fat, total calories 1,130; this is essentially a reduction diet, and is used only in obese patients.

Diet No. 2.—180 grams carbohydrates, 80 grams protein, 90 grams fat, total calories 1,730.

Diet No. 3.—220 grams carbohydrates, 100 grams protein, 125 grams fat, total calories 2,325. This is the standard diet. Thirty-eight of the 50 patients, or 73 percent were satisfied with this diet, gained weight and strength, and were easily regulated.

Diet No. 4.—300 grams carbohydrate, 115 grams protein, 135 grams fat, total calories 2,880. This diet was used in markedly undernourished patients. Twenty-one patients were successfully controlled with diet alone, and 29 required insulin.

Of the 29 requiring insulin 15 were successfully controlled with a single injection of protamine zinc insulin, ranging from 10 to 40 units. In the remaining 14 patients, a single morning injection of 40 units of protamine zinc insulin failed to control daytime hyperglycemia and glycosuria, despite a normal fasting blood sugar. Further increase in the dose of protamine would have incurred the risk of early morning hypoglycemic reactions. In general, patients requiring more than 40 units of insulin daily can be regulated more smoothly by combining the effects of protamine and crystalline insulins. It was formerly believed that this could best be accomplished by separate injections, but since the work of Peck (12) in 1942, it has been known that the two insulins can be combined in the same syringe in any desired proportions, thus, preparing a "tailor-made insulin" for each patient.

Protamine insulin as marketed is alkaline and contains a 40 percent excess of protamine, so that crystalline insulin added to it combines with the excess of protamine to form an increasingly saturated protamine insulin, intermediate in action between protamine and regular insulin. In such mixtures there is, as a rule, usually little demonstrable effect of crystalline insulin until a proportion of 1 to 1 is reached. A ratio of 2 parts of crystalline to 1 part of protamine zinc insulin is most satisfactory. Fourteen patients were treated with insulin mixtures, ranging in composition from 10 units of regular with 15 units of protamine, to 36 units of regular and 24 units of protamine. The individual dose is prepared and mixed in the syringe, and given as a single injection at the usual time before breakfast. By using this technique, no patient in the entire series required more than a single injection of insulin, and at the time of discharge all were sugar free and had normal blood sugars, not only fasting, but throughout the day.

Although diabetes has been characterized as "the disease of complications", in this series remarkably few were observed.

It is the complications of diabetes which render it a serious disease, and as has been emphasized by Murphy (13), the complications to be expected vary with the type of diabetes. In the diabetics under the age of 40 the principal complications expected are tuberculosis, pyogenic infections, and diabetic coma, while in the group past 40, arteriosclerosis and carcinoma become increasingly important.

In our series, tuberculosis, though sought for, was seldom found. The chest x-ray was normal in all except 1 case, which showed an old healed minimal apical tuberculosis. Nevertheless the frequent coexistence of tuberculosis and diabetes must be remembered. The adverse effect of diabetes in the prognosis in tuberculosis has been recently reemphasized in the studies of Banyai and Cadden (14). The following case, which was treated in another department of the hospital, is cited to illustrate the importance of remembering this relationship in all cases of tuberculosis, and in all cases of diabetes.

Case 4.—A 22-year-old pharmacist's mate was admitted on his ship complaining of fatigue, 40 pounds weight loss, and cough. A chest x-ray revealed an extensive exudative tuberculosis, with cavitation, involving the left lung. He was transferred to this hospital to await transfer to a tuberculosis unit. His progress was satisfactory, except for failure to gain weight. On the morning of 23 September 1945 the patient became stuporous and lapsed into coma. Marked dyspnea was noted. The examiner's impression was acute miliary tuberculosis. Spinal tap was normal except for a low pressure, 40 mm. of water. The patient remained in gradually deepening coma throughout that day. On the following morning he was seen in consultation, by the medical department, at which time dehydration, soft eyeballs, and Kussmaul respirations were noted. Urine analysis showed 4-plus reactions for sugar and acetone and the blood sugar was 969 mg. percent. No previous urinalysis was noted in the Health Record. After 2 hours of treatment, during which time 240 units of regular insulin were given the CO₂ combining power was 22 volumes percent. In the following 24 hours a total of 960 units of insulin was given together with 8,600 cc. of fluids. Acidosis was controlled within 9 hours and the blood sugar remained below 200 mg. percent after 15 hours of treatment. The patient failed to regain consciousness, and died 60 hours after the onset of coma.

Joslin has shown that it is the early administration of large doses of insulin which is the most significant factor in successful treatment of diabetic coma. In his recent series of 141 cases the average dose in the first 3 hours was slightly over 200 units.

Pyogenic infections likewise were seldom noted in this group. It was previously mentioned that recurring boils led to the diagnosis in 3 cases. One additional severe infection occurred while in the hospital.

Case 5.—A 38-year-old chief commissary steward noted thirst and polyuria while on Guam. Urinalysis showed sugar, and the fasting blood sugar was 214 mg. percent. On a regulated diet and 15 units of protamine zinc insulin glycosuria and hyperglycemia were controlled, and he was flown to the United States, arriving at the hospital on 21 April 1945. He complained of earache and was referred to the ear, nose, and throat department where a diagnosis of aerotitis was made, and the eustachian tubes inflated. Three days later he complained

of drowsiness, headache, and nausea. The urine was strongly positive for sugar and acetone. The temperature was 102° F., the blood sugar 178 mg. percent, and the CO₂ combining power 67 volumes percent. On examination the ear drum was reddened and the neck slightly stiff. The spinal fluid was cloudy, under increased pressure, and contained 1,300 cells, chiefly polymorphonuclear leukocytes. Culture showed 23 colonies of alpha-hemolytic streptococcus per cc. Under treatment with sodium sulfadiazine and penicillin he made an uneventful recovery.

In a known diabetic headache, drowsiness, and nausea and vomiting, with glycosuria and acetonuria naturally suggested impending diabetic coma. However, the presence of fever spelled a complication, and the normal CO₂ combining power at once eliminated the possibility. It is important to remember that diabetics may become unconscious from causes other than coma, particularly cerebral hemorrhage. When associated with glycosuria and hyperglycemia, as is frequently the case, errors in diagnosis are likely to result. The CO₂ combining power will distinguish them, as in diabetic coma it is below 20 volumes percent, and normal in coma from other causes.

No patients were admitted to this hospital in coma. In 2 cases however, coma was present or developed shortly after the original admission, and inasmuch as the circumstances of development were closely related to conditions peculiar to the service they are reported in some detail.

Case 6.—A 26-year-old seaman, first class, while at sea in very rough weather, complained of nausea, vomiting, and upper abdominal pain. He became drowsy and lapsed into coma. A diagnosis of seasickness was made and he was transferred to a hospital ashore, where dyspnea, dehydration, soft eyeballs, and acetone odor to the breath were noted. The urine was strongly positive for glucose and acetone, the blood sugar was 428 mg. percent. He was given 180 units of regular insulin and 4,200 cc. of parenteral fluids within 8 hours, at the end of which time he was out of coma and with a blood sugar of 143 mg. percent. On a regulated diet and 30 units of regular with 25 units of protamine zinc insulin his urine became sugar-free and his blood sugars normal.

Case 7.—A 20-year-old seaman, first class, felt perfectly well and had no complaints until 11 September 1945 while at sea when he noted fatigue, loss of weight, and severe nocturnal cramps in the legs. On 18 September he complained of abdominal pain, nausea, and headache. A urinalysis revealed 4-plus sugar. As he was on a small vessel which did not carry a medical officer, no insulin was available. He was given a low carbohydrate diet, but rapidly became worse. Three days later, when the vessel reached port, he was in deep coma, markedly dehydrated, with Kussmaul respirations, soft eyeballs, and a cherry-red color of the skin. He was transferred to a hospital, where the blood sugar was 384 mg. percent. Treatment consisted of 80 units of regular insulin in the first 7 hours, with 2,000 cc. of parenteral fluids. At this time the CO₂ combining power was only 25 volumes percent, and the blood sugar 210 mg. percent. Thereafter he was given 75 units of regular insulin daily until transferred to this hospital.

Case 6 illustrates the rapidity with which diabetic coma can develop. In this case it was the first evidence of diabetes and because of the association of nausea and vomiting with a rough sea the early symp-

toms were attributed to seasickness. Case 7 represents an unusual coincidence in the rapid development of diabetic coma under circumstances in which insulin therapy was not available. Even after hospitalization the insulin dosage was rather minimal, as is shown by the very slow improvement in the CO_2 combining power.

All diabetic patients are taught to test their own urine, to sterilize the syringe and needles, and to measure and inject their own dose of insulin. In addition they are given dietary instruction in the diet kitchen, become familiar with Wilder's diabetic manual, and are instructed in the nature of their disease. Their average stay in the hospital is 8 weeks, as all diabetics are discharged from the service by medical survey. During this period of observation great improvement is often manifested, so that patients who on admission required as much as 90 units of insulin daily, on discharge may require only 25 units or less. The great improvement in carbohydrate tolerance which may take place is illustrated by the following case:

Case 8.—A 24-year-old radioman, third class, 2 years previously had a fasting blood sugar of 461 mg. percent, required 190 units of insulin in the first 24 hours, and a daily dosage of 35 units for a prolonged period thereafter. Ultimately he was able to discontinue the use of insulin entirely, but a glucose-tolerance test 6 months later was definitely diabetic, with a fasting blood sugar of 175 mg. percent. He was put on limited duty, and eventually was admitted here for survey. The urine was normal, the fasting blood sugars repeatedly normal. The Exton-Rose test, however, showed a level of 174 mg. percent at the end of 1 hour, slightly within the diabetic range.

The improvement in tolerance in this patient is so remarkable as to suggest that for practical purposes cure of the diabetes has taken place. In view of the animal experiments of Best, it seems possible that the adage "once a diabetic always a diabetic" may some day be modified. For the present, at least, our objectives must remain: (a) Control of glycosuria; (b) control of hyperglycemia; (c) adequate nutrition of the patient; and (d) avoidance of insulin reactions. With little effort these objectives can be maintained in practically all cases, with a minimum of interference in the normal ways of life.

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EXPECTORANT ACTION OF VOLATILE OILS

Authors' summary.—Volatile oils and related compounds have been used as expectorants for many years and, as the reason for their introduction into therapeutics has been largely forgotten, their history has been reviewed in some detail. When given by stomach tube to guinea pigs, lightly anesthetized with urethane, the volatile oils of turpentine, pine, anise, lemon, and eucalyptus, and the related drugs terpin hydrate and terebene, were found to increase the volume output of respiratory tract fluid (R. T. F.). Oil of anise proved to be the most effective expectorant of the group and oil of turpentine the most effective terebinthinate volatile oil. The most effective dose was 50 mg. per kilo body weight. Compound tincture of benzoin, given by stomach tube, had no significant effect upon the volume output of the respiratory tract fluid (R. T. F.). Regarding species variation, oil of eucalyptus, taken as representative of the group, was shown to be expectorant in albino rats, guinea pigs, rabbits, cats, and dogs. In a cursory study of the chemical and physical properties of R. T. F., it was found that the expectorant volatile oils had no effect upon the concentration of R. T. F. chloride nor upon its specific gravity. Investigating the mechanism of expectorant action, it was shown that this effect was not influenced by section of the afferent gastric nerves, from which it was concluded that the expectorant volatile oils do not act reflexly from the stomach but probably directly upon the secretory cells of the respiratory tract.—BOYD, E. M. and PEARSON, G. L.: On the expectorant action of volatile oils. *Am. J. M. Sc.* 211: 602-610, May 1946.

RESEARCH IN THE NAVAL HOSPITAL¹

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Research has long been recognized as a vital part of naval medicine. During the war the unprecedented opportunities for furthering knowledge through research have been used to advantage, as evidenced by the prolific achievements of the Naval Research Institute, National Naval Medical Center, Bethesda, Md., and the five Naval Research Laboratories. Not to be overlooked among the impressive contributions of these centers are the smaller but often valuable studies by individual medical officers in the field.

The Research Division of the Bureau of Medicine and Surgery, established 2 years before Pearl Harbor, has given direction to naval medical research, and the current provision for clearing all formal projects through the Bureau assures coordination and avoids duplication of effort. From time to time directives concerning research have been issued, mentioning among other things the danger of overly ambitious undertakings. The necessity for this word of caution is in itself a commentary on the prevalence of research interest among naval medical personnel.

In the naval hospital, where some degree of spontaneous research interest is naturally to be expected, these warnings against misdirection of effort occasionally have been misconstrued. A few individuals have even interpreted them as constituting an official ban on all investigation, although the purpose and wording of the communications clearly is not to proscribe such activity but to channel the overall efforts of the medical department in the most advantageous manner. Much of the uncertainty has arisen from a failure on the part of individuals to differentiate between formal research on basic problems—involving large amounts of time, money, and sometimes risk—and the more informal type of investigation which any individual with the requisite interest and curiosity can pursue in the course of his normal activities. Clinical observations under controlled conditions for example, can be carried out in a naval hospital with no special equipment or any particular diversion of effort.

¹ The author acknowledges his indebtedness to Capt. Franklyn C. Hill (MC), U. S. N., for his interest in this study and the contribution he has made to it.

It is the purpose of this article, then, to examine the place of research in the naval hospital, to bring into fuller discussion the degree of research orientation and activity which seems appropriate, and to suggest ways and means for making more effective the investigations which are undertaken.

PLACE OF RESEARCH IN A NAVAL HOSPITAL

In the chain of activities executing the mission of the medical department the naval hospital lies midway between the forward field units treating casualties as they occur, and the research laboratory perfecting new methods for prevention and therapy. The hospital must be aware of, and to a degree participate in, the problems of both types of activities. Major medical research is beyond its scope, such projects necessarily being centered in a laboratory where a concentration of equipment and skilled personnel can be effected. It is a fact not to be forgotten however, that the ultimate proving ground of medical science is the clinical hospital. The more accurate the laboratory conclusion the more nearly the results of clinical experience will be predicted, but the final confirmation of the utility of new methods must come from clinical experience.

Although the primary function of the naval hospital is treatment and rehabilitation rather than research, it does have a definite responsibility in regard to scientific progress. It should, in the first place, have a sufficiently lively interest in the application of new findings to assure prompt utilization of the work of the research laboratory. Also, it should be alert to and report on the need for new basic research. Prompt recognition of trends, clinical variations, and new symptomatic manifestations are often the starting point of fruitful laboratory research. And finally, it should be able to appraise the results of its experience with new methods.

These obligations are best fulfilled when there is a healthy degree of research-mindedness among its staff, and a clear recognition that observations made under controlled conditions are superior to those made at random. Clinical research of this type is clearly within the province of the hospital and is an integral part of its activities.

The only restriction on research in the naval hospital is the requirement that it shall in no way detract from nor interfere with other fundamental responsibilities. Its investigations must therefore be primarily of a clinical nature, less extensive and less formal in character than research in a laboratory or medical center.

Nevertheless, the scientific approach can be employed to advantage in the study of *all* clinical problems, and small projects can be completed creditably. Research is a habit of mind rather than a set of

facilities; its essence is a desire to know more about the material with which one is working, and a willingness to try and find out. Careful observation, accurate recording, impartial weighing of evidence, readiness, if necessary, to accept unpalatable facts in preference to impressive illusions—these scientific attitudes are as valuable in the clinic as elsewhere. They are also, quite commonly, the qualities of mind found in the high-type clinician.

Men possessed of these capabilities find satisfaction in exercising them, and the Navy has its full share of such individuals. Encouragement of the attitudes of scientific investigation sharpens observation and introduces new interest into the mental life of the hospital.

The variety of hospital activities also favors a research atmosphere. The modern naval hospital is no longer solely a medical activity. Physicians comprise not much more than half its professional personnel. Red Cross personnel, chaplains, occupational therapists, recreational and physical fitness officers, educational officers, and psychologists have now joined the clinical team striving to rehabilitate the disabled, the diseased, and the maladjusted. These newer services need to be integrated to best advantage into the over-all medical program, and it is precisely at this point that research and evaluation studies are most urgently needed at the present time. A few of the officers of these newer services, like some physicians, are already research-minded and are eager to participate in investigative studies which will reveal weak spots and point the way to improvement.

The optimal utilization of these nonmedical services is a problem unique to the naval hospital, and research on this problem is the more important because of the newness of the activity. All forms of investigative and objective analysis are appropriate, from a brief inquiry into the type of educational courses most suitable for bed patients, to an over-all long-term appraisal of the various aspects of a physical fitness program. Large or small, all such investigations provide useful information for the command. Some will lead to the setting-up of more comprehensive studies. A small proportion will eventuate in published articles of scientific or medical interest.

A RESEARCH PROGRAM

It is within the power and discretion of the commanding officer to stimulate and facilitate clinical research, or to discourage it. Even his disregard of the situation will have its influence on his staff. If some degree of research-orientation is appropriate in a naval hospital, and we believe it is, three steps may be taken to foster its development.

1. Official approval can be given. One of the weekly clinical conferences may be given over to a discussion of the place of research in the hospital, and the attitude of the command indicated. Perspective

can be maintained by showing the necessary subordination of such activity to the primary function of treatment. The inappropriateness of projects requiring special funds or equipment can be pointed out and examples of feasible projects given. Controlled clinical trials of new methods can be differentiated sharply from haphazard irresponsible experimenting based on personal whim. The necessity and the reasons for Bureau approval of larger and more formal investigations can be made clear.

2. Practical assistance can be given in the form of providing supplies, such as temporary files and simple equipment made in the carpentry shop. Use of such office services as occasional mimeographing or typing can be permitted. Administrative facilitation can also take the form of reorganization of assignments to minor duties, small readjustments of schedules and routines, temporary permission to use certain offices at night, and similar concessions. None of these require, nor should they be allowed to cause, any interruption in the smooth and continuous execution of the major obligation of the hospital. Yet they constitute an important measure of assistance to an officer working hard to present his observations in that objective, publishable form which allows others to appraise and to profit from his experience with a particular clinical problem.

3. The third step which can be taken is to supply as much help as possible in the actual process of investigation, including both the formulation of research projects and the quantitative analysis of data obtained. A search through the hospital staff will usually discover some officer sufficiently versed in the techniques of research to provide this guidance. He may be a physician previously associated with a research organization. He may be a nonmedical specialist with a doctorate in some scientific field, who is familiar with the requirements of medical research. If no one person can be found capable of supplying this technical guidance, then it is possible that the combined experience of several officers may serve.

A RESEARCH OFFICER

A research officer, whether officially designated as such or not, can be of value in a number of ways.

Feasibility of project.—In the first place, a person experienced in research has better judgment of the feasibility of projects under consideration. This decision is not always an easy one for the man starting out for the first time to set down his observations in an organized fashion. Most initial attempts are too ambitious. They attempt to find out too much and wind up proving nothing except the inexperience of the investigator.

Formulation of problem.—Once a project is accepted as feasible, the form and pattern of the investigation must be worked out. This will include, depending on the type of problem, the kind of observations which are to be made, the manner in which they will be recorded, the degree of randomization of the sample, and the method by which cases will be selected so that experimental and control groups will be comparable. It is this stage of the research through which the novice invariably rushes in his enthusiasm to get at the “real problem.”

The experienced man, on the other hand, knows that “experimental design” is the most crucial part of any research, for a poorly conceived experiment can never result in anything but an indeterminate conclusion. The saddest of all research projects, and they are all too frequent, are those whose solitary conclusion is that “more work needs to be done * * *” The tombstones over these indefinite studies could all be inscribed “Faulty Design.” Care in formulation will prevent those hours of devoted but futile work which are the discouraging reward of misdirected research.

Quantitative analysis.—Analysis of results runs a close second as a weak spot in research. This is particularly true of clinical research where the material is predominantly quantitative in nature. Whenever observations are tabulated, whenever there are measurements, or percents, or incidences, or amounts, then some form of quantitative interpretation is inevitable. The importance of adequate statistical analysis is fully appreciated by those experienced in research, but among others there is a general lack of information both as to the methods themselves and the need for them.

Proportions, rates, averages, and differences are of uncertain significance until the amount of error to which they are subject is known. A value may be exact for the particular sample on which it is computed, but it is only an estimate for the larger population from which the experimental sample is drawn. Without knowing the error of this estimate, no sure generalization can be made. Differences found to exist between experimental and control groups cannot be considered significant unless it is first ascertained whether they exceed the degree of difference attributable to chance.

Analysis of this sort is essential if incisive conclusions are to be drawn, and a research officer is particularly helpful at this point. Even though he is not an expert statistician, an officer with research training will have at least a serviceable knowledge of statistical procedures and will be familiar with the basic requirements of quantitative analysis.

Presentation of results.—Aside from statistical help, those engaged in research will welcome advice on methods of presenting data. Definite conventions exist in regard to the form and use of tables, charts, frequency polygons, curves, bar graphs, and the like. Similarly, in

the preparation of manuscripts there are approved forms for footnotes, reference citations, headings, margins, captions, and similar details.

Guidance in all these technical aspects of research—from experimental design to preparation of manuscripts—contributes greatly to the incisiveness and value of the work done. An officer capable of providing such help can usually do so without infringing seriously on his other duties, and the aid he supplies materially increases the interest shown by others.

EFFECTS OF A RESEARCH PROGRAM

It is interesting to observe the increased alertness to clinical problems and the renewed enthusiasm which accompanies research that is in progress. The tonic effect on an active mind is unmistakable, and is mirrored in the number of after-work hours voluntarily devoted to tabulating and reviewing the day's observations. In the interests of morale, nothing is more stimulating to a routine-burdened officer than a slowly growing daily accumulation of data that is "going somewhere." The better conceived the project, the greater the satisfaction in watching it mature.

Not all officers, medical or nonmedical, are interested in investigation. Those who are will always, of course, be a minority, and the number will vary from time to time depending on a variety of factors. Some older men have other interests which occupy their attention and interest. Younger men often are absorbed in acquiring more general medical experience. Yet many of these individuals will be stimulated by the projects undertaken by others, and will follow them with equal interest.

A pervading interest in research, kept within proper bounds, tends to create a favorable tone and atmosphere in a hospital, improve the quality of general medical practice, and enhance the satisfaction of the individual officer in his work.

In this connection it is well to think of the future and the coming demobilization. The period between cessation of hostilities and release from active duty will seem a long one for reserve officers who, understandably, will be anxious to return to civilian activities. During this difficult period a program of research fills a mental gap and limits discontent by focusing the attention of medical and other officers on problems which have an inherent professional interest for them.

SUMMARY

1. From the research laboratory to the medical officer in the field, research is recognized as a vital part of naval medicine. This article discusses the place of research in a naval hospital.

2. Although the primary function of a hospital is treatment and rehabilitation, it also has a part to play in scientific progress. Prompt utilization of the results of basic research, alertness to new problems requiring investigation, and evaluation of its clinical experience with new methods and techniques, are responsibilities the hospital cannot avoid.

3. The investigative projects appropriate for its own undertaking are less formal in character than those of a research laboratory, and are primarily clinical in nature.

4. The integration and utilization of new nonmedical services to best advantage is uniquely a hospital problem, and is a fertile field for investigative studies.

5. Research orientation can be encouraged by official approval, assistance in practical ways, and by utilizing the experience of an officer on the staff with research training. A research officer is particularly useful in the formulation of projects and in the quantitative analysis of data.

6. Interest in research sharpens clinical observation, increases interest, and creates a favorable atmosphere in the hospital.

7. Demobilization will be a difficult period for reserve officers, and the natural restlessness of that period may be partially compensated by increased research on problems of professional interest.



SYMPATHETICO-ADRENAL DISCHARGES IN HYPOPHYSECTOMIZED RATS

Author's summary.—The hyperglycemic response to adrenalin secreted under conditions of anoxia, or to its injection is present for several days after hypophysectomy. This indicates that the hypophysis plays no direct rôle in sympathetico-adrenal reactions. However, this effect disappears in the course of several weeks following hypophysectomy although the fasting blood sugar level is not significantly altered. This failure of adrenalin to cause hyperglycemia is not explainable on the basis of the regressive changes in thyroid and adrenal cortex nor is it due to alterations in absorption since it is observed under conditions of anoxia when adrenalin is secreted into the blood stream as well as after intraperitoneal injection of adrenalin.—SAFFORD, H., WELLS, L., and GELLHORN, E.: Sympathetico-adrenal discharges in hypophysectomized rats. *J. Physiol.* 146: 386-388, June 1946.

A DESCRIPTION OF DISQUALIFICATIONS OF ENLISTED APPLICANTS FOR SUB- MARINE TRAINING¹

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This paper is a survey of disqualifications occurring in enlisted personnel being processed through the enlisted submarine personnel selection and training system. No attempt is made to probe the validities of any methods, the objective being simply to present the system exactly as it operates, and to make the areas requiring investigation and development stand out by showing the pattern of disqualifications.

The material for this report was gathered from several sources. In fact, if there is any value to this presentation, perhaps the first conclusion is that the submarine or any other similar activity should have a complete central file in which every examination is encoded. By maintaining such a file, weaknesses could be checked before they caused serious losses of manpower through erroneous disqualifications.

It must be emphasized that the data to follow in this paper usually relate to methods for applying principles rather than to principles themselves. This point must be borne firmly in mind in interpreting the statistics; failure to regard them in that light surely will mislead the reader. A great deal of misunderstanding has arisen in personnel work because of failure to distinguish between the validity of a principle and the validity of the method with which the principle is put into operation. The writers can recall, for example, a spirited discussion between two officials about dental examinations; one argued that dentists must revise their ways at a certain station because their disqualifications were accounting for half the rejections, and accord-

¹ From the Medical Research Department, U. S. Submarine Base, New London, Conn. The work reported was accomplished under a Bureau of Medicine and Surgery Research Project titled, "Analysis of Rejections in Examinations for Submarine School."

The material herein was submitted to the Bureau of Medicine and Surgery as an interim report which (a) summarized statistics presented in five monthly tabulations previously submitted, and (b) extended the analysis to preselection and training disqualifications.

The data for this paper were compiled through the generous cooperation of officers at the Submarine School at the Submarine Base, New London, the U. S. Naval Training Center, Bainbridge, Md., and the Bureau of Naval Personnel, Navy Department, Washington, D. C.

ingly there was little room for applying any other physical or aptitude standards; his opponent, on the other hand, contended that dental examinations were essential not only in order to preclude assignments of men who later would have dental trouble but also because dental condition was a good index of general health. Undoubtedly a reconciliation of the two levels of discussion would have found them in complete agreement. Both would have agreed that the principle of rejections for certain dental conditions was sound but that the principle was not applied wisely if it was allowed to override every other consideration. To repeat, then, the data in this paper relate to methods for applying medical and psychological selection principles.

OVER-ALL PATTERN OF SUBMARINE PERSONNEL SELECTION

The clearest and most logical method of handling this material to be presented is to follow the candidate from his entrance into the Navy through each step in the selection and training system. Figure 1 is a graphic tracing or diagram showing how the system functions.

To read the diagram, follow the arrows from the bottom to the top of the page. Each block represents a step in the system, and the items to the right of each block are reasons for rejections or failure at that level.

The range of percentages failing at each step are indicated. The tremendous variability will strike the reader at once. At the preselection level, for example, the figure cited for the proportion not accepted is 10 percent to 90 percent. Those figures are conservative estimates based on reports from various naval stations; at times some schools have sent 90 percent of the volunteers to New London, whereas the proportion sent from others was only a small fraction of the total number of volunteers. Similar fluctuation in the proportions rejected characterizes the other levels, but not to the same extent. The relative proportions and the fluctuation range for failures at each step are represented fairly adequately in the diagram. Representative data on failures at each selection or training step are elaborated in the sections following.

REJECTIONS IN THE PRESELECTION STAGE

The majority of enlisted candidates received for submarine training since early 1942 have been assigned directly to New London from training schools. Some of these schools have been an integral part of training center organizations, but others were not. The bulk of the candidates, then, was preselected at several different stations, so that the over-all authority covering selection at this stage was limited to the jurisdiction and direction that could be exercised from Washington by the Bureau of Naval Personnel and the Bureau of Medicine and Surgery. The remainder were sent to New London from surface ships, and so the authority that could be exercised over their preselection was even more limited.

Statistics on rejections are maintained by some of the preselection activities. Those for the Bainbridge Naval Training Center are cited in this report. A joint directive issued in October 1944 by the Bureau of Naval Personnel and the Bureau of Medicine and Surgery established Bainbridge as a station where a carefully prescribed routine of preselection should be followed. The statistics for that station may not be representative of those for other stations, but at least they apply to one comprehensive attempt at systematic preselection. As a matter of fact, the wide variation in preselection would lead one to suspect there is now no representative station. But the Bainbridge situation should be fairly typical of what may be expected when a comprehensive program like that prescribed in the BuPers-BuMed directives is applied. Briefly, the program specified an integrated series of (*a*) lectures, movies, and pamphlets explaining the submarine service and (*b*) a progression of medical, psychiatric, and aptitude examinations to screen volunteers after the service was explained. The progression was a successive series of eliminations. If a candidate failed one step he was disqualified at that point and did not continue through the remainder of his examinations.

Table 1 presents some data collected by the Classification Department of the Bainbridge Naval Training Center. Each step in this table deals only with the candidates who were successful at the level above. Thus to calculate the percentage failing the psychiatric examination one must remember the total number of men seen by the psychiatric department was only 1,045—those who passed the medical examination.

TABLE 1.—*Attrition in the general submarine selection program, Bainbridge Naval Training Center, January through June 1945*

Total number of volunteers processed.....	1, 548
Disqualified medically.....	503
Disqualified psychiatrically.....	56
Failed personal inventory test.....	61
Disqualified in aptitude interviews.....	285
Dropped (own request).....	44
Total number of volunteers dropped.....	949
Total number qualified for transfer to New London.....	599

According to table 1, medical rejections accounted for more disqualifications than any other single reason in the program outlined jointly by BuPers and BuMed, and of the total number of volunteers only some 35 to 40 percent were certified for transfer to New London. Yet, despite the high attrition rate, more than 10 percent of those assigned to New London during this period failed there in the examinations for submarine training. Furthermore, many of the New London rejections were medical. This suggests that the medical examination itself should be scrutinized.

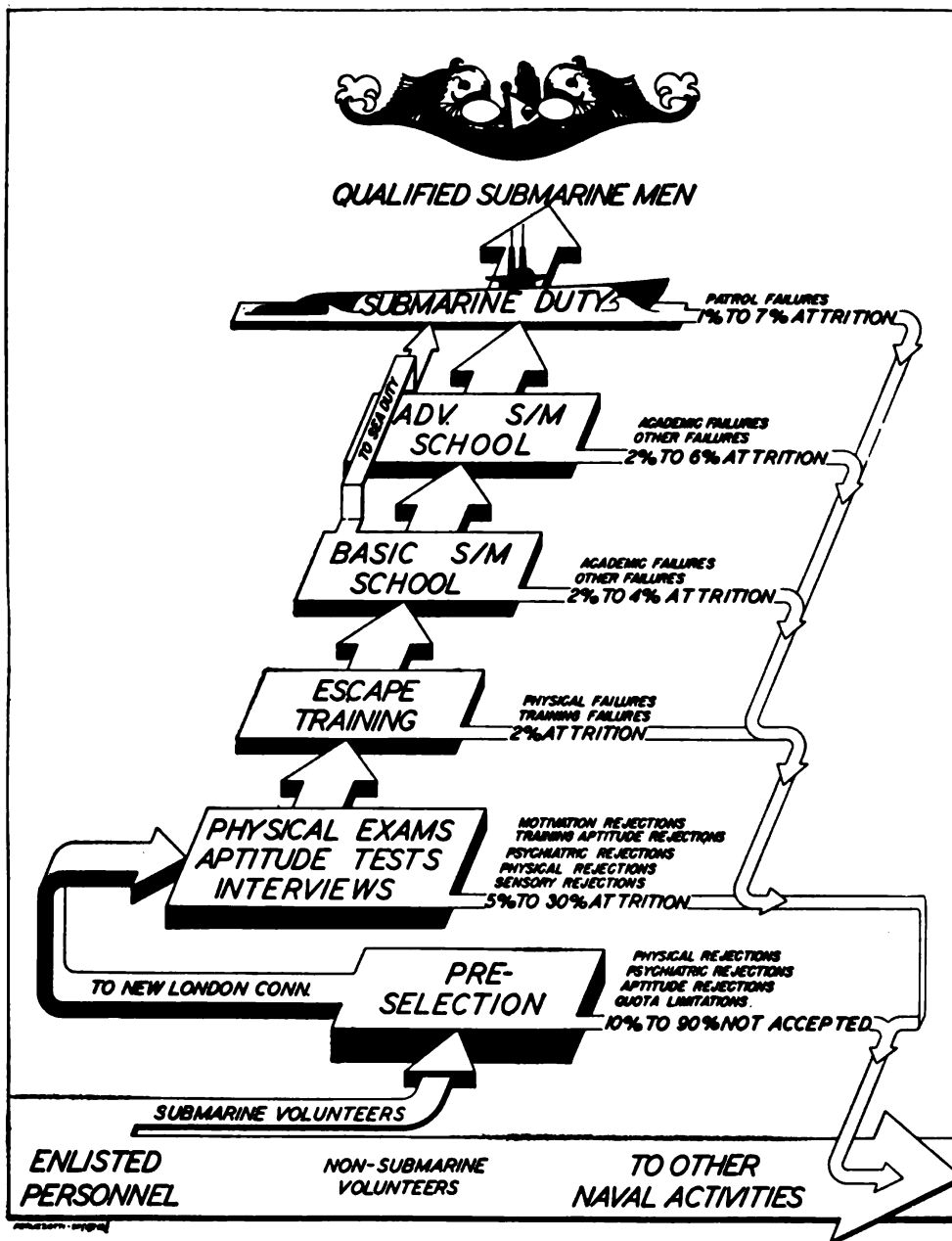


Diagram showing system of submarine personnel selection.

Table 2 is a summary of rejections, month by month, according to the reason for rejection, for submarine medical examinations at Bainbridge.

The wide fluctuation in table 2 for the proportions rejected under the various headings hints of fluctuating criteria as standards for rejection; and the headings themselves represent entities that have not been studied exhaustively for their validity. However, as stated earlier, the primary aim of this paper was to furnish data on the selection system as it now operates. And table 2, for whatever one may conclude from it, is a tabulation of reasons for 811 medical disqualifications for submarine duty. These medical examinations are presumed to have been conducted in accordance with the Manual of the Medical Department (pars. 21133.1 and 21133.2) but the reasons for disqualification do not conform to our interpretation of the examination for submarine duty.

TABLE 2.—*Submarine service medical examinations and reasons for rejection, 1 January to 31 August 1945, Bainbridge Naval Training Center*¹

Month	Number examined	Number qualified	Number not qualified	Reason for rejection										
				Color vision	Vision	Weight	Chest measurements and breathing	Orthopedics	Ear, nose, and throat	Heart and blood pressure	Previous medical history	Temperamentally unsuited	Genitourinary system and venereal	Dental
January	299	93	206	41	11	61	38	21	20	6	2	6		
February	260	192	68	2	7	13	10	9	11	10	1	3	2	
March	316	226	90	4	6	22	7	7	30	4		4	5	
April	240	150	90	4	4	24	10	9	23	3			13	
May	311	230	81	3	20	5		24	17	10			1	
June	327	233	94	1	15	2	5	38	27	2		4		
July	258	170	88	6		7		42	25	3		3		
August	332	238	94	6	14	13		18	29	8	4	2		
Total	2,343	1,532	811	67	77	147	70	168	182	46	7	22	21	

¹ This table was prepared by Lt. Comdr. G. M. Bell (MC) U. S. N. R. of the Bainbridge medical examining staff, 5 September 1945.

Incidentally, the discrepancies in total numbers in this table and in the numbers in table 1 for men processed during the same months by the classification department are attributable to scheduling factors. A man counted by the classification department as volunteering in one month may be examined by the medical department in another.

REJECTIONS IN PHYSICAL EXAMINATIONS, APTITUDE TESTS, AND INTERVIEWS AT NEW LONDON

All candidates assigned to submarine training are processed after arrival at New London in a program of medical and psychological tests. At the end of the examinations each is then interviewed

briefly, and the submarine medical examiner certifies him qualified for submarine training. An appreciable number are disqualified by the examiner. Then qualified candidates proceed to "escape training," the next level of processing shown in figure 1. At this level, there is still further attrition. Only when the escape training is completed is the man assumed qualified for Submarine School.

A man may be failed by the medical examiner for various reasons; there are five general classes of reasons for rejecting candidates at this level. A code of reasons for rejections has been drawn up, and the examiner describes each of his rejections by that code. A code reason under one or more of the headings is assigned each rejection. Table 3 lists the codes used since the beginning of 1944.

TABLE 3.—*Codes of reasons for rejection in New London examinations preliminary to submarine training*

MOTIVATION

1. Never volunteered, doesn't desire now.
2. Volunteered to avoid another duty, doesn't desire now.
3. Originally volunteered, requests other duty now.
4. Volunteered as alternative choice, requests other duty now.
5. Family opposition to submarine duty.
6. Inadequate motivation.

APTITUDE

1. Inadequate intellectual development.
2. Limited educational background.
3. Inadequate intellectual development plus limited education.
4. Limited aptitude for duties of rate.

PSYCHIATRIC

Diseases of Mind

- A. Constitutional psychopathic state—criminalism.
- B. Constitutional psychopathic state—emotional instability.
- C. Constitutional psychopathic state—inadequate personality.
- D. Dementia praecox.
- E. Nostalgia.
- F. Psychoneurosis.
- G. Somnambulism.
- H. Psychoneurosis, war neurosis.
- J. Disease of nervous system.
- M. Miscellaneous.

Tendencies Indicating Poor Psychiatric Prognosis

- N. Poor psychiatric prognosis indicated by history and background.
- O. Inadequate personality tendencies.
- P. Inadequate emotional stability—indicated by interview.
- Q. Inadequate emotional stability—indicated by psychosomatic symptoms involving enuresis.
- R. Inadequate emotional stability—indicated by psychosomatic symptoms *not* involving enuresis.
- S. Immaturity.
- T. Psychopathic tendency—military.
- U. Psychopathic tendency—civilian.
- V. Manic-depressive tendencies.
- W. Schizoid tendency.
- X. Miscellaneous tendencies.
- Y. Cumulative psychopathic inadequacy evinced through service situations.

PHYSICAL

- A. Nasal obstructions.
- B. Hypertrophied and diseased tonsils.
- C. Chronic sinusitis.
- D. Chronic otitis.
- E. Other disqualifying ear, nose, or throat conditions.
- F. Combination of ear, nose, and throat conditions.
- G. Defective gastro-intestinal system.
- H. Circulatory aberrations.
- J. Disqualifying chronic respiratory condition.
- K. Skeletal or muscular defect.
- L. Underweight.

- M. Disqualifying oral or dental condition.
- O. Offensive breath.
- P. Offensive or excessive perspiration.
- Q. Disqualifying chronic skin condition.
- R. Hernia.
- S. Syphilis.
- T. Obesity.
- U. Disqualifying genito-urinary condition other than those listed elsewhere.
- V. History of recent or frequent venereal disease.
- W. Enuresis, no apparent psychiatric basis.
- X. Miscellaneous.
- Y. Under age for Navy assignment.
- Z. Over age for submarine assignment.

SENSORY (seeing and hearing)

- 1. Low visual acuity.
- 2. Defective color discrimination.
- 3. Low auditory acuity.
- 4. Low visual acuity and defective color discrimination.
- 5. Low auditory acuity and defective color discrimination.
- 6. Low auditory acuity and low visual acuity.
- 7. Low auditory acuity, low visual acuity, and defective color discrimination.

Part B of table 4 presents a comparative summary of rejections by reason, month by month, according to the codes in table 3. The totals for the number rejected include those failed in escape-training. These rejections were made from the total of 3,601 candidates examined in the period January to July 1945 as shown in part A of the table. Four hundred and nineteen were failed at the time of interview and 45 were failed in escape-training. Altogether, 464, or 15.4 percent, were disqualified.

TABLE 4

A.—New London pre-school attrition

Month	Number examined	Number rejected	Percent rejected
January	779	80	10.3
February	560	50	8.9
March	589	72	12.2
April	513	70	13.6
May	426	76	17.8
June	373	56	15.0
July	361	60	16.6
Total	3,601	464	12.9

B.—Comparative summary of rejections by table 3 code reason

MOTIVATION

Month	Code reason						Total
	1	2	3	4	5	6	
January	0	0	12	2	4	14	32
February	1	0	10	0	0	4	15
March	0	2	8	0	3	14	27
April	1	0	20	0	6	11	38
May	0	0	10	0	7	10	27
June	0	0	7	0	0	7	14
July	0	0	5	0	2	9	16
Total	2	2	72	2	22	69	169

APTITUDE

Month	Code reason				Total
	1	2	3	4	
January.....	4	1	8	18	31
February.....	3	3	2	7	15
March.....	6	1	2	7	16
April.....	10	2	2	4	18
May.....	2	3	2	10	17
June.....	7	0	6	3	16
July.....	8	1	1	1	11
Total.....	40	11	23	50	124

PSYCHIATRIC

Month	Code reason																					Total	
	A	B	C	D	E	F	G	H	J	M	N	O	P	Q	R	S	T	U	V	W	X		Y
January	0	0	0	0	0	0	0	0	1	0	2	6	5	0	6	11	0	0	1	2	0	0	34
February	0	1	0	0	0	1	0	0	0	0	4	7	3	0	4	9	0	0	0	6	0	0	35
March	0	0	0	0	0	0	0	0	0	0	2	8	9	0	11	10	0	0	0	6	0	0	46
April	0	0	0	1	0	0	0	0	0	0	1	11	1	0	6	13	0	0	0	4	0	1	38
May	0	1	0	0	0	0	0	0	1	0	1	3	0	0	5	7	0	0	0	0	0	0	18
June	0	0	0	0	0	0	0	0	0	0	0	3	0	0	4	11	0	0	0	4	0	0	22
July	0	0	0	0	0	0	0	0	0	0	0	4	1	0	8	8	0	0	1	2	0	0	24
Total	0	2	0	1	0	1	0	0	2	0	10	42	19	0	44	69	0	0	2	24	0	1	217

PHYSICAL

Month	Code reason																							Total		
	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X		Y	Z
January.....	0	0	0	1	0	0	0	2	1	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	8
February.....	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
March.....	0	0	0	0	2	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
April.....	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
May.....	0	0	0	2	0	0	0	3	0	2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	9
June.....	0	0	0	2	1	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	7
July.....	0	1	0	1	0	0	0	3	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	8
Total.....	0	1	0	6	3	1	0	11	2	8	0	2	0	0	1	1	0	3	0	0	0	0	1	0	0	40

SENSORY

Month	Code reason							Total
	1	2	3	4	5	6	7	
January.....	9	2	4	0	0	0	0	16
February.....	4	1	0	0	0	0	0	5
March.....	6	2	0	0	0	0	0	8
April.....	6	1	2	0	0	0	0	9
May.....	10	3	5	0	0	9	0	27
June.....	11	2	1	0	0	2	0	16
July.....	15	3	3	0	1	0	0	22
Total.....	61	14	15	0	1	11	0	102

Table 5 is a break-down of the same data according to some natural grouping of sources from which the candidates come. Schools and Training Centers are to be contrasted with All Others; Pharmacist's Mates and Radio Technicians constitute special groups with different and unique selection problems.

TABLE 5.—*Break-down of comparative summary of rejections according to source, January to July 1945*

Source	Number examined	Number rejected	Percent rejected	Reason for rejection					
				Motivation	Aptitude	Psychiatric	Physical	Sensory	Under-water escape training
Schools and training centers.....	2,400	280	11.7	89	47	139	21	66	36
Pharmacist's mates.....	81	26	32.0	17	16	8	1	0	1
Radio technicians.....	330	17	5.2	4	0	10	3	3	3
All others.....	790	141	17.9	59	61	60	15	33	5
Total.....	3,601	464	12.9	169	124	217	40	102	45

The patterns of disqualifications for Schools and Training Centers and All Others differ from each other because of differences in the Navy experience of the candidate population. Then, too, Schools and Training Centers have fairly well defined programs of examinations for selecting submarine trainees from their student populations, whereas there is every kind of preselection, from good to bad, for choosing from the experienced Fleet men for transfer to New London. Furthermore, for nearly a year preceding the period represented in these data, each school received monthly reports from the Submarine Base listing the candidates from that school, and detailing the code rejection reasons for every man failing. And medical representatives from New London endeavored to keep in close touch with every school furnishing submarine candidates. So there are a lot of reasons for expecting the personnel attrition for Schools and Training Centers to look better than that for All Others. The difference is most striking under the Aptitude heading. That might be anticipated, since it is the factor that can be most readily brought under control.

The coding system in table 3 is considered far from satisfactory, primarily because some reasons are broad categories that mean very little. On the other hand the codes are ample for clear-cut cases of disqualifications. Perhaps their inadequacy lies primarily in covering rejections for questionable qualifications. The numbers listed for various reasons indicated by letter under the heading "Psychiatric" in table 4 emphasize this weakness. Note that of the total of 217 rejections described under this heading, 42 are O (tendencies denoting inadequate personality), 44 are R (inadequate emotional stability) and 69 are S (immaturity). At the same time there is a total of

only 6 rejections under the letters A through M, for positive disease conditions. In other words, the bulk of the rejections falls in the rather vague, indefinite, catch-all categories that do not seem to involve a completely disabling inadequacy. Many of those coded with psychiatric deficiency also were assigned a reason under other headings. A deficiency under "Motivation" is especially likely to be assigned with a "Psychiatric" disability.

The coding method should be revised to permit the examiner to be more explicit in his description of cases involving questionable adequacies of 2 or 3 types. In summary, then, the codes in table 3 do not succeed in covering every rejection adequately; so the table 4 summary is somewhat distorted because quite a few cases involved 2 or 3 reasons, no one of which alone existed to a degree warranting disqualification.

The distortion is not so great as to invalidate the pattern of the disqualifications apparent in table 4, however. Note that the heading with the greatest attrition is "Psychiatric"; and note, too, that vision and hearing tests ("Sensory") together account for more than twice as many disqualifications as do the physical examinations. These results are valid descriptions of rejections at this level.

ESCAPE TRAINING REJECTIONS

Every candidate is required to learn the use of the submarine escape appliance. The course of training prescribes actual underwater escapes from air-lock compartments through a column of water. During the training some men have middle-ear difficulty in adjusting to the changing air pressure; and some manifest a great deal of anxiety in making the underwater escapes. As a rough rule of thumb, 1 man in every 100 will be a pressure failure, and 1 an anxiety failure. Of the shown 3,601 candidates in tables 4 and 5, 3,182 passed the examination procedure up to this level, but 45 of these were later failed either because of pressure difficulty with their ears or because they showed too much anxiety during training. Thus, for both reasons combined, 1.4 percent of those attempting training were disqualified. During the year 1944, of 13,094 candidates received 126 were disqualified for inability to equalize for pressure and 107 were disqualified because of poor training performance. And during the early part of the war these figures tended to run somewhat higher. But from a comparative over-all attrition standpoint the underwater escape-training program has not been very expensive of personnel.

SUMMARY OF PRESCHOOL ATTRITION AT NEW LONDON

In table 6 the failures at the examination and escape-training levels are combined to show the total preschool failures,² from the beginning of the war through 30 June 1945. The percentage rejected is calculated by dividing the number failed by the total number examined, when accurate figures for the latter were maintained. They were not maintained in convenient form before 1944, so the number received is assumed as the divisor for computing the percentage rejected for those periods.

In the 43 months 33,011 men (covered by table 6) were received for training, but 6,040 or 18.3 percent were disqualified before they were enrolled in submarine school.

TABLE 6.—Numbers of men received for submarine school and preschool drops

Year and quarter	Received	Examined *	Rejected	Percent rejected
1941—7 December-31 December.....	73	-----	4	5.0
1942—January-March.....	868	-----	75	8.6
April-June.....	1,111	-----	128	11.5
July-September.....	1,407	-----	296	21.0
October-December.....	1,480	-----	230	15.5
1943—January-March.....	2,307	-----	280	12.2
April-June.....	2,571	-----	528	20.5
July-September.....	2,916	-----	704	24.1
October-December.....	4,036	-----	727	18.0
1944—January-March.....	4,211	-----	896	21.0
April-June.....	3,554	3,262	785	24.0
July-September.....	2,886	2,856	653	22.9
October-December.....	2,443	2,382	330	13.8
1945—January-March.....	1,830	1,928	202	10.5
April-June.....	1,318	1,312	202	15.3
Total.....	33,011	-----	6,040	18.3

² A systematic seasonal fluctuation in the percentage failed can be discerned in table 6; there is a higher failure rate in the summer months than in the winter. This tendency has been speculated upon a great deal. Some ascribe it to a seasonal fluctuation in the caliber of men coming into the service. They assume the lower winter attrition reflects the predominance of the high school graduates who came into the training centers the previous June and July. However, the writers favor an alternative explanation for the lower winter attrition. Since only firm volunteers are accepted for duty, the failure rate is an index of the general prevailing motivation for submarine duty and for all the prerequisite hard work which that duty involves. On cold winter days, classroom work in a warm building is a fairly appealing prospect, and sea duty promises only cold and misery. On hot days in the summer the situation is reversed. In direct contrast to the discomfort of the candidates in taking medical examinations, there are men on surface craft on the river just below them with a cool breeze and a lot of time on their hands. To the writers it is little wonder that in the summer more candidates present mixed attitudes about submarine duty. It might be simply a matter of weather. So the writers prefer to attribute the seasonal fluctuation apparent in table 6 primarily to the New England climate rather than to any differences in caliber of the candidates.

REJECTIONS IN BASIC AND ADVANCED SUBMARINE SCHOOL TRAINING

Basic school is a 6-weeks' course in theory and operations of submersible ships. The course was required for everyone except steward's mates. The percentage of failure up until 1 July 1945 is shown in table 7.³

TABLE 7.—*Numbers of men rejected in basic submarine school training*

Year and quarter	Graduated	Failed	Percent failed
1941—7 December–31 December.....	148	5	3.3
1942—January–March.....	403	20	4.7
April–June.....	850	33	3.7
July–September.....	936	33	3.4
October–December.....	1,244	19	1.5
1943—January–March.....	1,329	54	3.9
April–June.....	1,988	51	2.5
July–September.....	1,715	49	2.8
October–December.....	3,029	43	1.4
1944—January–March.....	2,919	88	2.9
April–June.....	3,250	113	3.4
July–September.....	1,912	76	3.8
October–December.....	2,188	78	3.4
1945—January–March.....	1,443	54	3.6
April–June.....	1,398	55	3.8
Total.....	24,752	771	3.02

It is difficult to describe the history of failures in the advanced training system because the program has been flexible, and because a description of the advanced training in one rate is not a valid history of the training in another. As a matter of fact, any analysis of failure in the advanced submarine schools emphasizes the primary dependence of attrition rates upon administrative policies.

Table 8 shows the failure rate for 3 populations in basic and in 5 advanced training schools. The populations are separated by date of receipt into 3 separate time periods; that is, the division into 3 groups is made according to the intervals when the candidate came to New London. The failures and graduations that are the bases for the statistics might not have taken place during the same interval of receipt. Note the variation in percentages rejected. The Battery and Gyro and and the Ordnance Schools seldom reject a candidate, whereas the others fail about 1 man in 20. Furthermore, as illustrated by the Radio drops, the percentage failed by a given school varies from time

³ Note the seasonal fluctuation in this table. As in table 6, for preschool rejections the failure rate during warm weather tends to be greater than in cold.

to time. Efforts on the part of this activity to identify corresponding differences in the various school populations have not been successful. It is assumed that the over-all statistical differences from school to school and from period to period may simply be a matter of differences in administrative policies.

TABLE 8.—*Failures in submarine schools for trainees received in 3 separate periods*

School	February-June 1944			July-December 1944			January-June 1945		
	Number received	Number dropped	Percent dropped	Number received	Number dropped	Percent dropped	Number received	Number dropped	Percent dropped
Basic.....	5,345	173	3.2	4,254	154	3.6	2,671	128	4.8
Diesel.....	1,449	61	4.2	1,033	52	5.0	517	19	3.7
Battery and Gyro.....	1,126	10	.88	645	10	1.6	507	5	.98
Ordnance.....	1,029	2	.19	701	4	.57	315	2	.63
Quartermaster-Signalman.....	435	20	4.6	385	42	10.9	352	34	9.7
Radio.....	416	21	5.0	348	22	6.3	392	45	11.5
Total, 5 advanced schools.....	4,455	114	2.6	3,112	130	4.1	2,083	105	5.0

For every man dropped, the submarine school submits a report listing one or more reasons for the failure. Reasons assigned are taken from a standard list of failure reasons. Table 9 is a summary of the failure reasons for the drops in table 8. Note that the general pattern of failures differs from school to school, and is not constant for a given school for all three periods.

TABLE 9.—*Reasons¹ assigned for training failures in submarine schools in 3 separate periods*

January-June 1944										
School	Reason for failure ¹								Total	Total dropped
	1	2	3	4	5	6	7	8		
Basic.....	74	47	25	5	5	57	8	47	268	173
Ordnance.....	0	0	0	0	0	1	0	2	3	2
Quartermaster-Signalman.....	9	14	9	3	2	1	1	8	47	20
Diesel.....	35	19	1	0	3	15	1	10	84	61
Battery and Gyro.....	3	3	0	0	2	2	1	4	15	10
Radio.....	20	14	0	2	1	3	0	2	42	21
Total.....	141	97	35	10	13	79	11	73	459	287

See footnote at end of table.

July-December 1944

School	Reason for failure ¹								Total	Total dropped
	1	2	3	4	5	6	7	8		
Basic	74	75	43	8	5	30	8	24	267	154
Ordnance	0	0	1	0	0	1	0	3	5	4
Quartermaster-Signalman	24	27	7	1	2	8	0	11	80	42
Diesel	30	30	3	1	0	6	4	7	81	52
Battery and Gyro	2	2	0	3	2	2	1	2	14	10
Radio	15	16	7	1	1	0	0	3	43	22
Total	145	150	61	14	10	47	13	50	490	284

January-June 1945

School	Reason for failure ¹								Total	Total dropped
	1	2	3	4	5	6	7	8		
Basic	59	60	21	23	29	9	25	15	241	128
Ordnance	0	0	0	0	0	0	1	1	2	2
Quartermaster-Signalman	9	12	11	3	3	4	2	11	55	34
Diesel	8	8	7	5	6	5	1	2	42	19
Battery and Gyro	1	1	1	0	0	1	3	2	9	5
Radio	18	27	8	5	7	3	1	4	73	45
Total	95	108	48	36	45	22	33	35	422	233

¹ Reasons for failures are coded as follows:

- 1= Lack of ability to do academic work of speciality.
- 2= Lack of ability to do practical work of speciality.
- 3= Lack of application.
- 4= Unwillingness to do the work assigned.
- 5= Temperamentally unfit due to lack of desire for submarine service.
- 6= Temperamentally unfit for submarine duty.
- 7= Physically unfit for submarine duty.
- 8= Disciplinary problem.

COMMENT ON PATROL FAILURES

No detailed tabulations of data on patrol attrition for submarine school graduates have come to the attention of this activity. However, on the basis of (a) patrol reports, (b) individual comments, and (c) analysis of some 3,000 rating sheets for evaluating enlisted personnel that have been submitted by submarine commanding officers, it is obvious that the attrition rate is relatively low. The failure rate is probably of the order of 1 or 2 percent.

TABLE 10.—*Commanding officers' evaluations, after patrol, of 409 white enlisted men from 6 submarines, according to selection source*

Source	Evaluations			Total
	Transfer	Average	Superior	
New London selection and training system	3	164	100	267
Unknown	6	90	46	142
Total	9	254	146	409

Table 10 is a representative sample of the state of affairs. This is a tabulation of evaluations of white enlisted men submitted by commanding officers of 6 submarines reporting in from patrols. The names for the men evaluated were then identified according to whether

the man came into submarines through the New London selection and training system. Table 10 shows a breakdown of evaluations, "Transfer," "Average" and "Superior," for the 2 populations. "Transfer" denotes the incompetent men the commanding officer intended to transfer from the ship; these may be assumed to be the "Fail" groups. Of the 9 men from 6 ships who were considered unsatisfactory, 6 evidently never came through the system depicted in figure 1.

Once again, however, the patrol attrition figure, whatever it may be, is dependent primarily upon administrative policies and aptitudes. Standards of performance for submarine enlisted men are set high, but the applications of these standards require judgments and evaluations by several hundred executive and commanding officers. On the whole those officers find praise for submarine school graduates. Certainly the failure rate for submarine school graduates at the level of submarine operations against the enemy may be considered negligible in proportion to the tremendous antecedent attrition in selection and training.

OVER-ALL ILLUSTRATION OF THE SYSTEM AFTER PRESELECTION

The receipts during January and February 1944 from 3 schools were traced by studying their records on file in the Bureau of Naval Personnel in August of the next year. The 3 schools studied were the Electrician's Mates Schools at Bainbridge, Md., Minneapolis, Minn., and Ames, Iowa, and the total received was 105. Just how large a group was examined at those 3 stations to yield this number for transfer to New London is uncertain. As a guess, the total number of volunteers represented is probably somewhere between 200 and 500. Table 11 is a historical sequence of the 22 failures that took place in the next 14 to 18 months after the group was received. Insofar as the service records indicated, the remaining 83 were serving satisfactorily aboard submarines. Table 11 is modeled after figure 1; to trace the successive drops from the total group of 105 received at New London, trace table 11 from bottom to top.

TABLE 11.—*Summary of 22 disqualifications after perselection for 105 men received in January and February 1944, from 3 Electrician's Mates Schools (Bainbridge, Md., Minneapolis, Minn., Ames, Iowa)*^{1,2}

Name	Reason for disqualification	Disposition as of August 1945
<i>Patrol failures</i>		
V	Failed physically at Pearl Harbor.....	To surface craft.
U	Did not want submarine duty.....	To submarine tender.
<i>School failures</i>		
T	Psychiatric recommendation—based on poor school performance.	To surface craft.
S	Did not want submarine duty	Do.

See footnotes at end of table.

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TABLE 11.—Summary of 22 disqualifications after persclection for 105 men received in January and February 1944, from 3 Electrician's Mates Schools (Bainbridge, Md., Minneapolis, Minn., Ames, Iowa)^{1 2}—Continued

Name	Reason for disqualification	Disposition as of August 1945
	<i>Underwater escape training failures</i>	
R	Motivation, nervous line performance.....	To surface craft.
Q	Nervous performance on escape line.....	Do.
P	Nervous performance on escape line.....	Do.
O	Failed pressure.....	Do.
	<i>Physical drops</i>	
N	Defective color discrimination.....	Do.
M	Low visual acuity.....	Do.
	<i>Interview and aptitude drops</i>	
L	Psychiatric; physical.....	Do.
K	Training aptitude.....	Do.
J	Psychiatric; physical; sensory.....	Do.
I	Psychiatric; physical.....	Do.
H	Motivation; psychiatric.....	Discharged, U. S. Naval Hospital, Newport, R. I., 11 June 1945.
G	Motivation; psychiatric; sensory.....	Discharged, U. S. Naval Hospital, Newport, R. I., 10 July 1945.
F	Psychiatric; physical.....	To surface craft.
E	Psychiatric; sensory.....	Do.
D	Motivation; physical.....	Do.
C	Motivation.....	Do.
B	Training aptitude; psychiatric.....	Do.
A	Training aptitude; psychiatric; physical.....	Do.

¹ Consider this table in conjunction with fig. 1.

² Of the 105 men received 93 qualified submarine men are on submarine duty, according to examinations of service records in August 1945.

GENERAL COMMENT

As illustrated in figure 1 and elaborated in this paper, the total selection and training system is a progression of steps, with failures at each level. The problem of integrating the steps must now be considered.

Each of the levels in the New London phase is a self-integrated unit, with failures at a given level effected only if the over-all judgment of the individual from the various points of view at the level indicates disqualification. That administrative philosophy is implemented through the interview method. For example, a final interview at the end of "Physical examinations, aptitude tests and interviews" (fig. 1) is designed to draw together all the information available for an over-all judgment of whether to accept the man for training. Similarly, the assistant Officer-in-Charge of the Submarine School interviews each student who has been referred to him as a case for disqualification.

In addition to unifying each level, there is an effort to integrate the various levels. Thus, for example, if there is a question about whether a man's performance in underwater escape training warrants disqualification, all the available information from previous records and examinations is consulted. And before a man is dropped from

school on doubtful evidence, all the available test records for that man are assembled and utilized in the interview by the school authority.

At the preselection level, however, examinations frequently do not fit together into a single administrative unit. Instead, preselection may consist of a progression of many examinations, each independent and each accounting for a sizable proportion of rejections. Integration into some unitary system would reduce the numbers disqualified for single minor defects.

Medical rejections appear to predominate over all others. For this reason especial care to use standard examinations must be exercised. And research on the reliabilities of particular techniques for evaluating the presence of each disqualifying factor would seem in order. Studies of the reliabilities and validities of methods for measuring visual acuity and auditory acuity⁴ have proved valuable in reducing the waste of personnel, and the same approach in the other areas of the medical examination seems promising. Undoubtedly large numbers have been disqualified on the basis of inadequate judgments that certain defects are present; even if the Manual of the Medical Department is followed to the very letter there will be many such disqualifications until exact and reliable procedures can be established. Finally, extensive research in the validity of the several aspects of the medical examination should be undertaken.

At the beginning of this paper it was suggested that careful periodic accountings of reasons for rejections would reduce manpower wastes. Because Pars. 21133.1 and 21133.2 of the Manual of the Medical Department (outlining the physical examination for submarine duty) are not always followed this accounting might more than pay for itself just by spotting erroneous physical qualifications. Certainly a central accounting would help in an over-all integration of the system.

SUMMARY

A schematic diagram of the successive steps for selecting and training enlisted submarine men is presented. Personnel attrition at each successive step is treated briefly. The aim of the paper, however, is to present a general description of the personnel selection system. Statistics are tabulated to show the over-all picture from the beginning of the war until the end of June 1945.

Only the New London system is described. During the early part of the war men were transferred to submarine duty from various sources and were trained aboard submarines. The procedure was not systematic and was considered unsatisfactory. All other methods

⁴HARRIS, J. D.: Group audiometry. *J. Acoust. Soc. Am.* 17: 73-76, July 1945.

for selecting and training men were discontinued as soon as the New London school was supplying the necessary volume of trained men.

From the standpoint of relative numbers disqualified, medical selection seems to predominate over any other type. A man may fail somewhere in the system for any one or more of a larger number of reasons. But if one knew only that a certain volunteer failed to get into submarines, he would be making a reasonable estimate if he assumed that volunteer was a medical rejection. Therefore, because medical factors have such a tremendous significance, the validity and reliability of the examination method for determining the presence of each disqualifying medical factor should be determined. Then those examination methods should be standardized.

The greatest variation in attrition is at the preselection stage. Representative disqualification data for this level are presented for one large naval training center. In the opinion of the writers, those data emphasize the need for a corps of doctors and technicians especially trained in selection theory and examination technique.

One incidental item noted in tables of attrition for pretraining and training rejections at New London since the beginning of the war was an apparent seasonal variation. This illustrates the extreme complexity of the problem; evidently even the season of the year must be borne in mind by medical examiners in weighing the statements of applicants for submarine duty!



IMMUNOBIOLOGICAL DIAGNOSIS OF TULAREMIA

Both serum agglutinations with tularemia antigen and the intradermal allergic reaction to "tularin" were found to be specific and highly reliable tests for tularemia. The skin test becomes positive in 75.6 percent of the cases during the first week of infection and in 94.7 percent after longer periods of time. The agglutination reaction is slightly less reliable, especially in the first 2 weeks of infection. Nonspecific group reactions are rare in tularemia patients and cross-reactions in cases of brucellosis and with *Brucella* antigens are insignificant.—DROBINSKY, I. R.: The immunobiological diagnosis of tularemia. *Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii* (Moscow) 1943 (7/8): 13-22, 1943; *Biol. Abstr.* 20: 948, May 1946.

EPIDEMIC OF PRICKLY HEAT ON AIRCRAFT CARRIER

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An epidemic of prickly heat (*miliaria rubra*) developed on an aircraft carrier during combat operations in the Tropics. The seriousness of the epidemic, as well as a consideration of the causative factors and treatment found effective, is discussed in this article.

On 15 July 1944 a sudden increase in the incidence of prickly heat was noted in the outpatient clinic. It soon became evident that this condition would be an unsolvable problem so long as the ship was operating under the existing conditions of heat and humidity, because of the large number of men reporting daily, and the ineffectiveness of treatment measures available. To quote one well-known author "treatment is simple, consisting mainly in the avoidance of external and internal agents which produce perspiration—clothing should not be excessive, silk underwear being worn." Every person suffering from prickly heat would no doubt be heartily in agreement with this treatment.

In general, the disease presented the typical appearance described in any textbook on diseases of the skin. There was frequently a complicating fungous infection increasing the difficulty of treatment. In this discussion all cases in which prickly heat was the primary factor are considered.

On 16 July a special record was kept of the outpatients treated for prickly heat. The number rose to 25 or 30, all obtaining treatment three times a day. Studies on the wet and dry bulb temperature of the various living compartments where the men also sleep, were begun. The wet and dry bulb outside air temperature of the ship taken at 1000 each day and entered in the ship's log, was recorded. The percentage incidence of the disease as to divisions and living (sleeping) compartments was ascertained, and a questionnaire submitted to 71 sufferers. The period covered extended from 15 July to 1 October.

TABLE 1.—Data on patients admitted to sick list, and average outside air temperature for last 4 months of study. (Temperature of water varied little from 86° F.)

	Month					
	April	May	June	July	August	September
Number of admissions.....	0	2.0	5.0	43.0	31.0	14.0
Total number of sick days.....	0	7.0	22.0	168.0	105.0	50.0
Average number of sick days per patient.....	0	3.5	4.4	3.9	3.2	3.6
Average effective temperature (degrees).....			82.0	82.0	81.0	80.0

Table 1 illustrates the importance of the disease. The "average effective temperature," was obtained from the daily wet and dry bulb temperature readings of the outside air at 1000, as recorded in the ship's log. The "effective temperature" figure was derived from the wet and dry bulb thermometer readings as described in reference 3*a*. In general, the effective temperature is a measure of subjective warmth. It correlates the wet and dry bulb readings in a figure which measures the net physiological effect on the body. An effective temperature of 86° F. is the upper limit at which heat balance can be maintained at rest without a rise in body temperature without compensating increase in air flow (3*b*). The water temperature surrounding the ship averaged 86° F., and fluctuation was not sufficient to assume importance.

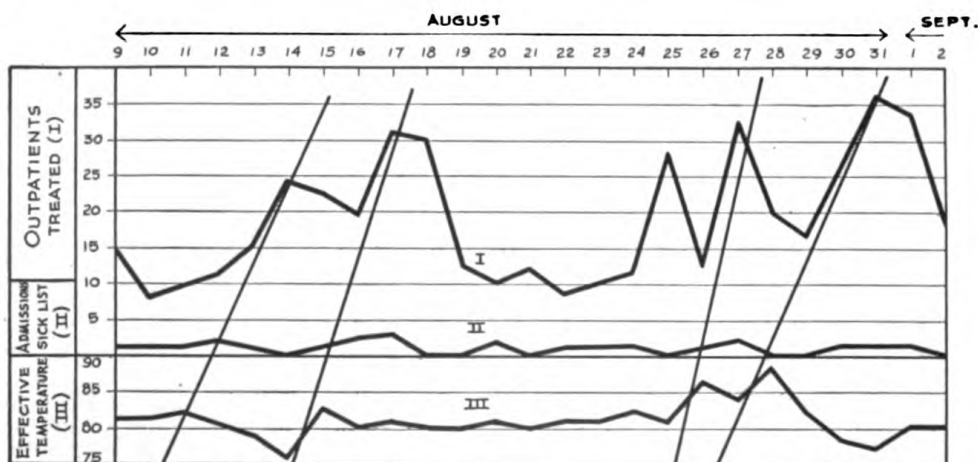


FIGURE 1.—Demonstrating a rough but definite correlation between the effective temperature of the outside air and the number of prickly heat patients.

Figure 1 shows the relationship between the effective temperature of the outside air and the number of patients seen suffering from prickly heat. Both admissions to the sick list and outpatients treated are shown for the period 9 August to 2 September. Similar correlation was

found present during the entire period of the survey. It must be realized that the only patients considered in the survey were those seen at the sick bay. It is hard to estimate the total number of sufferers aboard ship, but is probably safe to say that a considerable proportion of the crew has suffered with it at one time or another.

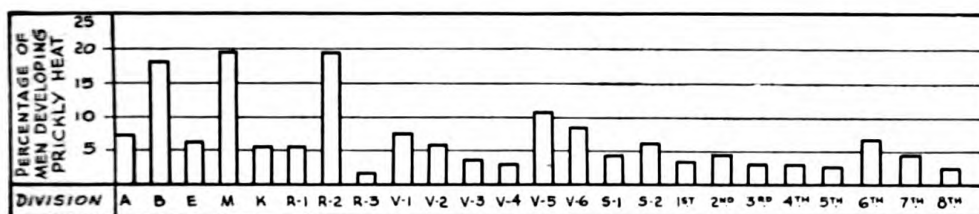


FIGURE 2.—Percentage incidence in divisions, period June, July, and August.

The percentage of men in various divisions who suffered from the condition at any time from July to September was determined and is shown in figure 2. It will be noted that the A, B, E, M, R-2, V-5, and V-6 divisions have the highest incidence. The A, B, E, and M divisions are the engineering divisions, and include men who work in the firerooms, engine rooms, workshops, and other locations where they are subject to heat above that endured by the average man on the ship, or who perform work below decks that increases the production of body heat. Of the other two divisions, the majority of men perform duties requiring more than the average physical exertion.

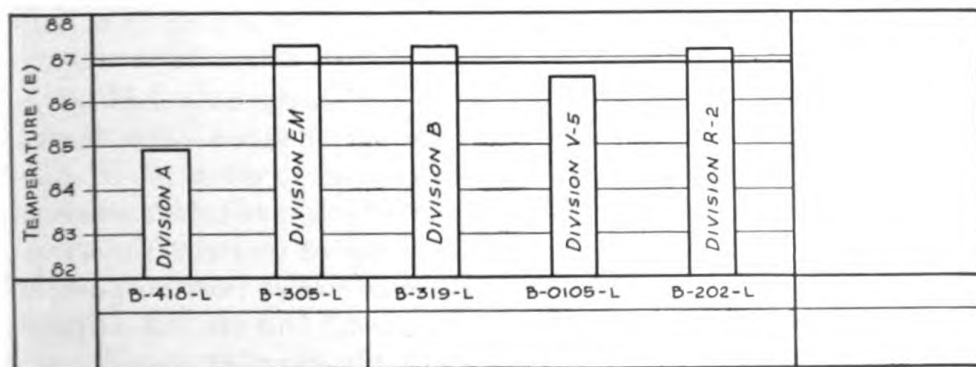


FIGURE 3.—Showing the average temperatures of compartments having an incidence of over 15 percent of men affected during the period 15 June to 1 September as compared with the average temperature of 11 representative compartments during the same period. (Living and sleeping compartments.)

The percentage of patients suffering from the condition in various living (sleeping) compartments was determined. In figure 3 the average effective temperature of living (sleeping) compartments having an incidence of over 15 percent of men affected (compartments, B-418-L, B-305-L, B-319-L, B-0105-L, and B-202-L), is compared

with the average effective temperature of 11 representative living compartments on the ship. It is noted that the men in these compartments are the ones who constitute the divisions having the highest incidence. Since the average effective temperature of those compartments does not seem significantly above the average effective temperature of other living compartments on the ship (86.7° F.), the high incidence must be explainable only by the environmental working effective temperatures of these men, or by the nature of their work which invokes excess of body heat. It shows that if a man has to work in a hot place during the day he needs to sleep in a cool place at night in order to avoid becoming a prickly heat casualty.

TABLE 2.—*Answers obtained on questionnaire submitted to 71 prickly heat patients*

Question	Answers	Cases	Percent
Cause?	Heat, sweating, poor ventilation, hot climate, etc.	59	83
	Other	12	17
Most effective treatment?	Cool place, including sick bay	19	27
	Various medications	21	30
	None	28	39
	No answer	3	4
Do you take salt tablets?	Yes:		
	6 a day, or more	8	11
	Less than 6 a day	27	38
	No	36	51
Sun helps?	Yes	36	51
	No	29	41
	No answer	6	8
Time topside?	1 hour or more	52	73
	1 hour or less	17	24
	No answer	2	3
Uncomfortably warm at night?	Yes	64	90
	No	5	7
	No answer	2	3

It was thought of possible interest to question the men themselves as to their opinions on the condition. Seventy-one men were issued a mimeographed questionnaire, and the answers to questions of possible value are tabulated in table 2. It should be noted that, whereas there is a difference of opinion as to the value of sunlight, time topside and "most effective treatment," the men are at least 80 percent agreed that heat, sweating, "poor ventilation," and the hot climate is the cause, and that they are "uncomfortably warm at night."

As to treatment, many different remedies were tried, all without definite specific effect. Vitamins, salt tablets, sodium bicarbonate, aspirin, and other medicines were tried internally without noticeable effect. Evaluation of medications was almost impossible due to fluctuation in environmental temperature. A decrease in the effective temperature, brought about a "cure" in many cases regardless of what treatment was used, in proportion to the beneficial degree of change. Although the sick bay was mentioned by only 25 percent of men as being the "most effective treatment," it must be remembered that, proportionally, only very few of these men were admitted to the sick

list. Of those that were, response was invariably rapid and complete within a few days. It may be said of local medications applied to the skin that 1 percent menthol in 70 percent alcohol gave symptomatic relief. For those cases complicated with a fungous infection, tincture of merthiolate applied frequently, was moderately effective. A period in the air-conditioned sick bay,¹ or a beneficial change in the weather was far more effective than any medication.

Although the authors are not qualified to render an opinion as to the causative mechanism of the condition, it is postulated that prickly heat is an allergic response of the skin to heat, and has its normal counterpart in the development of "goose-pimples" on exposure to cold. Many sufferers have noted an immediate "breaking out" of the uncomfortable rash upon stepping into a hot compartment. Any condition or state of mind which causes increased body heat, provokes the response in those conditioned. From personal observation of the authors, it has been observed that after a certain period of freedom from the condition, the "allergic response" disappears, and hot compartments can be entered without effect.

SUMMARY

1. Prickly heat is an important disease under conditions of combat operations in the Tropics, being the cause of many lost man-days, as well as the source of much annoyance and discomfort in those in whom the condition is mild. It also places a heavy burden on the Medical Department at an unfavorable time.

2. There is no specific remedy except to improve the effective environmental temperature.

3. Reassignment of bunks should be effected when possible to enable men working in hot spaces or performing heavy physical work, to sleep in the coolest parts of the ship.

4. Measures to decrease the effective temperature of vessels of this type during combat operations in tropical waters are necessary if the loss of man-days, the annoyance, discomfort, and consequent lowering

¹ Temperature readings of the sick bay as compared with the temperature of the outside air bear the following approximate relationship, explainable by the installation of an air conditioning (cooling) machine :

	Dry bulb	Wet bulb	Effective temperature
Outside air temperature.....	85	78	81
Sick-bay ward.....	80	75	77
Net cooling obtained.....	5	3	4

All readings in Fahrenheit degrees.

of morale and decrease in over-all efficiency of the crew are to be prevented.

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PROTEIN REQUIREMENTS OF ADULTS

Authors' summary.—1. Nitrogen balance studies on 26 adults in apparent good health were made using a low-protein diet, devoid of animal protein, in which approximately 50 percent of the protein was supplied by white bread, 12 percent by other cereals, 30 percent by vegetables, and 8 percent by fruit. Adequate calories to maintain caloric equilibrium were supplied by sugars, starch, and fats. It was found that the nitrogen requirement is more closely related to surface area (basal caloric expenditure) than to body weight. The requirement for maintaining nitrogen balance was approximately 2.9 gm. of nitrogen (18 gm. conventional protein) per square meter of body surface. A man weighing 70 kilograms would thus require between 30 and 40 gm. of protein, depending upon height.

2. On the same diet with one-third of the protein replaced by meat, the requirement appears to be about 2.4 gm. nitrogen (15 gm. conventional protein) per square meter. Protein requirement is thus about 17 percent less on this diet than on the all-vegetable diet.

3. Data on digestibility and biologic value were determined and the equal importance of these two measurements for evaluating the nutritional value of a protein is emphasized. High quality proteins are more efficient, but less efficient proteins may serve equally well, provided enough can be fed to cover the requirement considering specific digestibility and biologic value.

4. The biologic value of the low-protein all-vegetable diet used in these studies was increased from 72.5 to 80.4 by replacing one-third of the protein with meat. The digestibility of the two diets was essentially the same.

5. There was no measurable objective change in the physical condition of any of the individuals throughout these studies. Some complained of undue postprandial hunger and fatigue on the low protein all-vegetable diets. These complaints were not present on high protein diets.—HEGSTED, D. M., TSONGAS, A. G., ABBOTT, D. B., and STARE, F. J.: Protein requirements of adults. *J. Lab. & Clin. Med.* 31: 261-284, March 1946.

SCLEROSING OSTEOMYELITIS OF GARRÉ

With Report of a Case

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Sclerosing osteitis of Garré is not a common condition. However, in the consideration of bone diseases it should be definitely kept in mind. In addition it should be kept in mind by both the internist and the neurologist, for it simulates various conditions. The case reported in this paper indicates the vagary of diagnosis. This is certainly true of some of the other cases reported in the literature.

The condition was first described in 1893 by Garré (1), and since then other cases have been described by various authors. However, the number of cases reported is still a rather small one.

In any discussion of this condition it is necessary to consider several other conditions which may resemble it. The differential diagnosis may be easy or it may be difficult. It may simulate another disease. Proper diagnosis is important for the treatment of some of the conditions which Garré's osteomyelitis may simulate is radical.

The etiology of the condition is not known, although injury is claimed by authors to be a factor. However, many state that the injury may even be forgotten.

Chronic sclerosing osteomyelitis is a form of osteomyelitis that is nonsuppurative. It resembles a diffuse infection of the bone in its sclerotic process in bone. It occurs usually in the diaphysis of the long bones, most commonly the femur or the tibia. Occasionally there are diffuse areas (9) (10) (14) or one area, which contain purulent matter. In some cases staphylococcus cultures may be obtained, but in the great majority sterile cultures are reported.

A few of the cases have been reported with the signs of local inflammation, slight fever, and general malaise. Generally, however, there is an absence of any constitutional symptoms.

The onset of the disease is usually slow and insidious, and often the history is vague and indefinite. These factors add to the difficulty of diagnosis. The diagnosis can usually be made, however, by the clinical history and the roentgenographic evidence, together with remembering the triad of symptoms. (These will be discussed later.)

Several authors believe that diffuse chronic sclerosing osteomyelitis and Jaffe's osteoid osteoma and Brodie's intracortical abscess are re-

lated (6) (9) (10) (14). They give evidence to support this contention by remarking on the instances of Garré's osteomyelitis that have one or more small areas of rarefaction visible (which may represent abscesses or osteoid areas (10)). These are noticed by x-ray and by pathological examination. In this connection there is thought to be considerable overlapping if not actual relationship between chronic bone abscesses and chronic sclerosing osteomyelitis. Kleinberg (6) and Key (10) believe that osteoid osteoma and chronic sclerosing osteomyelitis are the same condition, especially since osteoid tissue is found on occasion in the latter condition. Most authors (3) (4) (5) (7) (11) (12) (15), however, believe that the conditions are separate and distinct.

The following case report will indicate the difficulties of diagnosis from a surgical and roentgenological standpoint.

CASE REPORT

A 35-year-old chief pharmacist presented himself with the chief complaint of an indefinite dull ache in the right forearm of 1 year's duration. This was located in the mid-dorsal region of the upper third of the forearm. It was more or less steady. Diathermy afforded some relief as did exercise of the arm. At night-time the pain was worse and prevented sleep; it necessitated walking the floor and using aspirin tablets. In the past 3 months the pain became worse and none of the methods previously used for relief were of any avail.

Consultation with several medical officers offered no relief. An x-ray of the right forearm 4 months previously was reported as negative by the roentgenologist.

The past history revealed a fracture of the right mandible 2 years previously. There were no other illnesses beyond several of the childhood diseases without complications.

The family history was noncontributory.

Physical examination revealed an asthenic middle-aged male whose posture was poor, and who appeared somewhat fatigued and nervous. Temperature 98.6° F.; pulse 78; respiration 18; blood pressure 132/84. The head and neck were normal. There were no scalenus signs. The chest, heart, and lungs were all normal. The genitalia were normal. The extremities revealed reflexes present, equal and active. The right arm showed a mild general atrophy. A small fibrotic mass was palpated in the upper third of the right forearm dorsally. It lay alongside the lateral radius. It seemed to be immovable and was exquisitely tender and localized at that point. Motions, both active and passive, of the wrist and elbow affected neither the pain nor the nodule. The vascular and neurological statuses of the limb were normal. No sensory or motor changes were noted. The other extremities were normal.

Another x-ray study of the right forearm was made at this time, and it appeared that there was some increased density in the upper third of the radius with a narrowing of the medullary cavity. Consultation with the roentgenologist resulted in the x-ray being considered normal.

A neurosurgical and an orthopedic consultation were of no aid in establishing a diagnosis. A follow-up consultation 1 month later by both departments resulted in the orthopedic department considering a probable neuroma as being

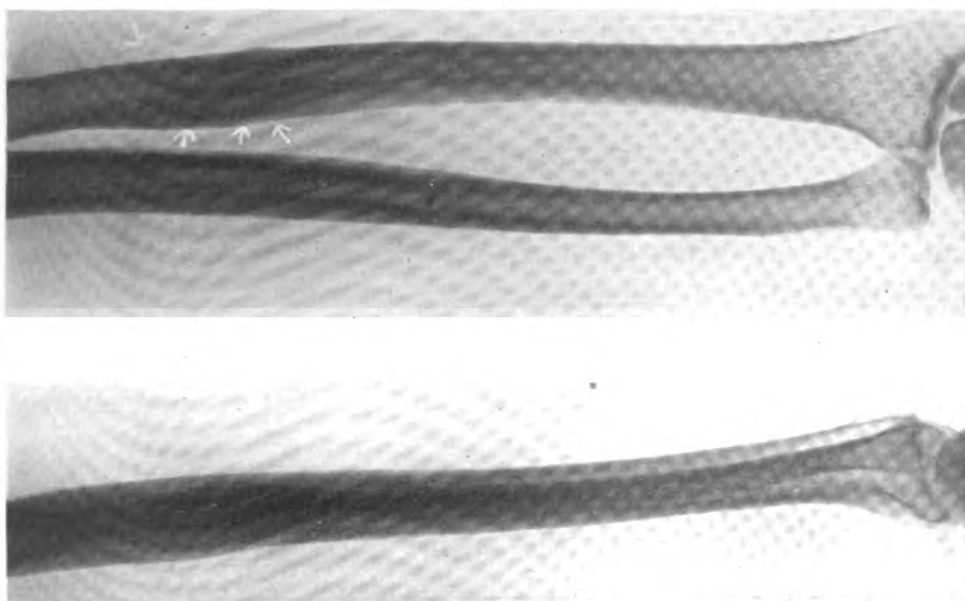
present; and the neurosurgical department as considering it as a probable fibroma of a tendon. Both departments, however, suggested an exploratory operation of the arm. An exploratory operation was thought advisable, recommended and was carried out.

Laboratory workup revealed a red cell count of 4.4 million per cmm., a hemoglobin of 94 percent, a white cell count of 8,500 per ccm. with a normal differential. Blood chemistry revealed a non-protein nitrogen of 29 mgms. per cc., glucose of 121 mgms. per cc., calcium of 11 mgms. per cc., phosphorus of 3 mgms. per cc. The acid phosphatase was 2.0 units and the alkaline phosphatase was 14.0 units. Urinalysis was normal. A blood Kahn was negative.

An exploratory operation was performed under local novocaine anesthesia, an incision being made over the nodule. On exploring within the incision a small protrusion of the radius was noted. Pressure and rubbing over this produced the same pain complained of. This nodule was ronguered down to the depth of the medullary cavity. Free bleeding was obtained from both ends of the incision. No further pain could be elicited after this was accomplished. The wound was then closed by interrupted sutures in layers without drainage.

Pathological examination of the ronguered bone disclosed sclerotic bone with some mild surrounding inflammatory reaction consistent with a diagnosis of chronic sclerosing osteomyelitis.

A review of all the preoperative and postoperative films made by the x-ray department was reported as follows: The operative defect 1.5 cm. in diameter involves the posterior portion of the cortex of the radius at the junction of the proximal and middle thirds. The cortex of the bone in this region is thickened and sclerotic. These changes existed prior to the operation and are probably the result of the sclerosing osteomyelitis of Garré in the right radius. Postoperative defect of right radius. (See figure.)



Lesion in right radius outlined by arrows.

The patient was observed for a period of 4 months after operation, and he had full normal function and complete freedom of all symptoms.

COMMENT ON CASE

This case presented a problem in diagnosis, but the triad of symptoms of localized pain, tenderness, and the x-ray findings with the negative laboratory tests and the absence of any constitutional symptoms should have led to the diagnosis. The fact that the roentgenologist considered the x-ray plate negative, despite the suggestion of the clinician that an area on the radius was abnormal, confused the diagnosis. The diagnosis was eventually established by exploratory operation and pathological study. However, if the condition had been kept in mind the diagnosis should have been made preoperatively.

DIFFERENTIAL DIAGNOSIS

There are several different pathological conditions which might lead to confusion with chronic sclerosing osteomyelitis. Ewing's endothelioma and osteogenic sarcoma are not too difficult to rule out (2). The former condition can be recognized by fever, osteoporosis and expansion of the marrow cavity. It occurs in early adult life and usually in the long bones. Osteogenic sarcoma with its pain, constitutional symptoms, rapid growth and surrounding invasion cannot long be unrecognized. The sclerotic type of osteogenic sarcoma is more apt to cause confusion than the other types of the sarcoma.

Paget's disease is a condition with multiple lesions; roentgenographically it exhibits areas of decreased density with coarse lines through them and the cortex of the bone is dense. In addition the serum phosphatase is increased. Syphilis of the bone may have to be differentiated, but the absence of the history of lues and positive serology will make known the true nature of the disease. Periostitis extends over large areas in syphilis of the bone.

Sclerosing osteomyelitis can be recognized if the characteristic subjective and objective symptoms are remembered. It is a lesion with a triad of characteristic symptoms as noted: Localized pain, tenderness, and typical x-ray findings (2) (3) (4). (See differential diagnosis chart).

Garré's osteomyelitis has a typical roentgenologic appearance (2) (3) (4) (8) (13). In the area of the disease there is increased density with a narrowing of the marrow canal. Eventually there may be a tendency to complete obliteration of the marrow canal, although usually a marrow canal of small diameter persists. The density is ascribed to the laying down of new bone in the Haversian canals so that these become largely obliterated. The diagnosis can be made from the x-ray. The differential characteristics were discussed under the differential diagnosis.

Differential diagnosis chart for diseases resembling sclerosing osteomyelitis of Garre

Disease or condition	History	Etiology	Symptoms	Number of lesions	Age	Usual bone involved	X-ray findings	Other data
Garre's sclerosing osteitis.	Gradual onset. Rather long duration.	Unknown.	Pain of moderate severity. Usually at night. Dull ache. General condition good.	Single.	Before 30 years	Femur and tibia	Thickened cortex, fusiform, symmetrical. Partial or complete obliteration of marrow shaft.	Growth comes to a standstill.
Syphilia.	History of lues.	Syphilia.	Pain, tenderness. Thickened tissues.	-----	Any age.	Any bone.	Sclerotic and osteolytic areas. Periostitis with layer of formation of new bone over cortex. Heavy outline.	Positive serology
Ewing's endothelial myeloma.	Pain and fever with remissions.	Unknown.	Pain, fever in long bone.	Primary lesion.	10 to 20 years.	Long bone.	Tibia, femur, humerus. Osteoporosis. Narrow cavity expanded.	
Osteoid osteoma.	Long history.	Unknown.	Pain, dull, aching. Worse at night. Finger point tenderness.	Single.	20 to 30 years.	Long bone extremities, skull facial bones.	Oval or rounded lesion less than 2 cm. Rarefied and sclerosing areas.	Males. No metastasis.
Osteogenic sarcoma.	Rapid onset. Definite appearance of symptoms.	Unknown.	Pain. Rapid growing tumor. Constitutional symptoms. Atrophy.	-----	Any age.	-----	Long end of bone raises periosteum. Sunray calcified areas. Medullary cavity may be obliterated and cortex dense.	Rapid growth.
Paget's disease.	Rather long history with constitutional symptoms.	Metabolic.	-----	Multiple lesions.	-----	Tibia and femur.	Areas decreased density with coarse lines through them. Dense cortex.	Increased serum phosphatase.
Brodie's intracortical abscess.	Gradual history. Rather prolonged story.	Unknown.	Pain for weeks or months. Not severe at first. Increases in intensity. Worse at night.	Single.	Adult.	Long bone, most frequent site lower end of tibia.	Localized area of density in metaphysis near the epiphyseal line.	Swelling may be palpable and visible.

TREATMENT

The treatment of this condition is quite standardized. Most authors (1) (3) (4) (5) (6) (7) (10) believe that rongueering or saucerization down to the medullary cavity with tight closure will adequately treat the condition and result in cure. Some surgeons recommend the use of multiple drilling with good results, but Key (10) urges caution and avoidance of this method of treatment since in his experience several cases treated in this way had exacerbations with resultant diffuse osteomyelitis.

Chemotherapy is recommended before and after operation in those cases that have diffuse bone abscesses present.

Operative treatment relieves all symptoms and usually there are no recurrences of the disease.

SUMMARY

1. A discussion of the diagnosis of chronic sclerosing osteomyelitis (Garré osteomyelitis) is made. The triad of symptoms of the disease is stressed, and keeping the disease in mind is emphasized.

2. A case of chronic sclerosing osteomyelitis in which the diagnosis was obscured, because it was not kept in mind by the roentgenologist, and finally was made by exploratory operation, pathological examination, and retrospect of the x-rays is presented.

3. The specific purpose of this paper is to direct attention to this relatively rare form of disease.

4. The treatment of this condition is discussed.

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TESTS AGAINST CHIGGERS IN NEW GUINEA

Author's summary.—A simple method for impregnating uniforms and blankets with dimethyl phthalate was developed to protect troops against scrub typhus.

Materials and equipment necessary to apply the treatment consisted of water, laundry soap, dimethyl phthalate, a kitchen egg whip, empty oil drums and a means of heating the water to dissolve the soap.

Laboratory and small-scale field tests, conducted near Oro Bay, New Guinea, against *Schöngastia pusilla* and *Trombicula bulolocensis* indicated that satisfactory protection would be given by clothing immersed in an emulsion of 5 percent dimethyl phthalate in 2 percent soap solution. After drying in the sun, the clothing was ready for wearing.

Tests indicated that the treated clothing could be expected to protect the wearer from chigger bites from a period of 5 weeks of occasional wear or until it would be changed for laundering. The treatment was indicated to withstand profuse sweating or wearing in the rain. Treated clothing was still toxic to mites after being worn for 15-minute wading in fresh or salt water, but prolonged wading removed the dimethyl phthalate from the clothing. The treatment withstood rinsing in cold water but not the usual methods of field laundering.

When untreated shorts were worn to protect the scrotum there were no ill effects from wearing impregnated clothing.

The treatment was widely and successfully used by troops exposed to scrub typhus in the Pacific Theater during the last year of the war.—BUSHLAND, R. C.: Tests against chiggers in New Guinea to develop practical field method for impregnating uniforms with dimethyl phthalate for scrub typhus prevention. *Am. J. Hyg.* **43**: 219-229, May 1946.

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A TECHNIQUE OF LOCAL USE OF PENICILLIN IN THE OPERATIVE TREATMENT OF CHRONICALLY INFECTED INGROWN TOENAILS

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Facilities on a destroyer in the Pacific preclude the controlled physical and detailed academic research which precedes the publication of most worth while papers. Occasionally, however, small points of technique are stumbled upon which provide significant improvement in the care of common ailments. In recent months a technique of local administration of penicillin which seems to fall into this category has been evolved on the destroyer to which the author is attached.

In the climate of both the North Atlantic and the Central Pacific we have been troubled with a relatively high percentage of chronically infected ingrown toenails among the enlisted men. Both our teaching and experience have indicated that these toes do poorly and afford a limited but continued disability until the lateral extensions of the nail, those portions of the base of the nail which have been undermined by purulent exudate, and all infected granulation tissue in the paronychia spaces have been removed. To assure the permanence of postoperative relief it is felt that the matrix under the offending lateral portions of the nail must be removed down to the periosteum of the base of the distal phalanx, almost as far back as the reflection of the capsule of the joint.

It is usually impossible to clear up the infection in a typical chronic paronychia associated with an ingrown toenail until this dissection is carried out; thus a semielective operation opening a relatively large tissue surface must be performed in a dirty field if a permanent cure is desired. This relatively extensive dissection is therefore often followed by a period of discomfort, with swelling and cellulitis of the toe, which is often sufficient to keep a man on the sick list from 5 to 10 days, even though it is seldom accompanied by any systemic reaction. This factor makes many reluctant to operate on these toes at sea, where all hands are needed at their regular stations, and often serves to make them timid about performing a sufficiently

extensive procedure when they are finally compelled to operate by reason of the patient's nonimprovement.

It was concluded, after worrying along with several men who were disabled for quite a long postoperative period, that the infection which develops following operation must begin on the surfaces created by the operation itself, for all chronically infected tissue is removed when the operation is correctly done. Postoperative cellulitis therefore should be prevented entirely if these surfaces were sterilized in the immediate postoperative period, when they are freely exposed and readily accessible, and subsequently redressed with careful asepsis. The technique evolved, which has been eminently satisfactory, is next described.

METHOD

The affected toe is scrubbed, after thorough cleansing and shaving, with alternating alcohol and zephiran-soaked sponges and a 2-percent procaine nerve block is accomplished at the base of the toe. A sterile rubber tourniquet is then placed by the operator and a modified Winograd procedure is carried out. Special care is taken to remove adequate lateral slices of the nail and underlying matrix with associated granulation tissue, until the remaining central portion of the nail is opposed by healthy paronychia folds, and the periosteum of the proximal expansion of the distal phalanx is exposed (fig. 1). The eponychial fold, between the two lateral incisions, is fully reflected to allow complete examination of the base of the nail and permit easy removal of any portion which may have been separated from its matrix by exudate. A fine-mesh, dry gauze wick is then packed into the raw spaces thus created (fig. 2). A small rubber tube whose end has multiple small openings is then placed over and parallel to the eponychial fold, and the proximal end of the tube is led through a slit in a piece of sterile gauze which is used to cover the wound (fig. 3). A sterile 1-inch bandage is then snugly applied over the gauze and tubing and the whole dressing covered with Scotch tape. The exposed portion of the tube is then secured to the base of the toe with a silk tie, sharply doubled back on itself over the Scotch tape, and the end secured with an additional silk tie (fig. 4). Three cubic centimeters of penicillin solution (2,000 Oxford units per cc. in distilled water) is then injected through the tube and a small dressing applied over the outer end of the tube to keep it sterile.

The rubber tubes, about 4 inches long, have been fashioned out of the soft aspirator tubing used with ordinary blood counting pipettes. This is universally available, inexpensive, and fits the glass tip of a standard syringe well. The Scotch tape protects the dressing from drying, and the wound can be kept constantly moist with penicillin

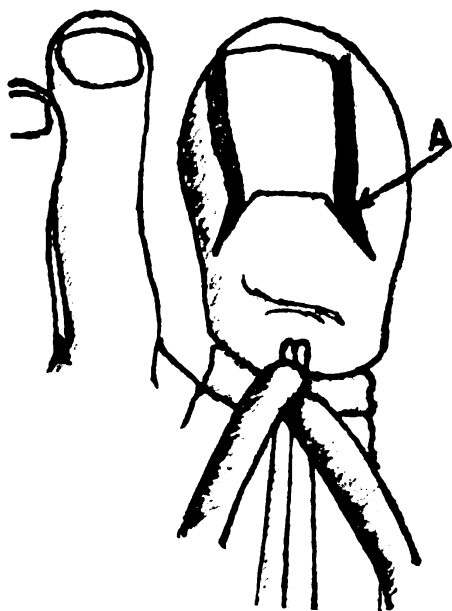


FIGURE 1.—(A) Periosteum visible at this point.

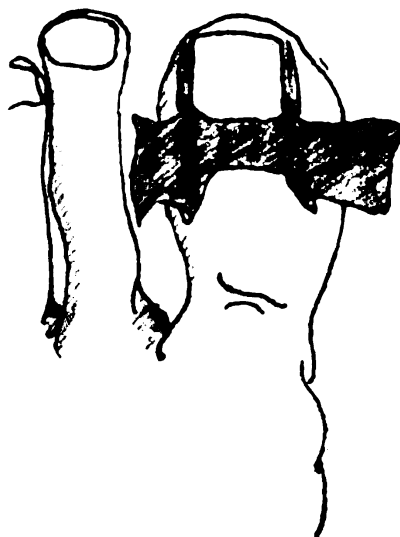


FIGURE 2.

solution when the injections are 3 or 4 hours apart (when 6 cc. are injected at midnight, the dressing is still slightly moist at reveille the following morning). The sharp angle, produced where the tube is doubled back over the tape, admits the penicillin solution easily if it is injected under slight pressure, and prevents it seeping back through the tube. The outer dressing, which maintains sterility of the end of the tube, is easily removed for each injection by sliding the tip of a

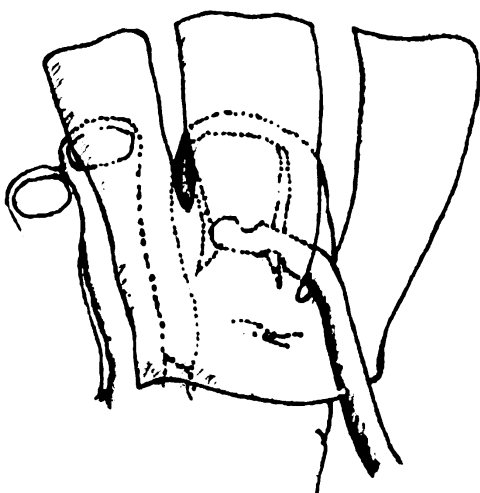


FIGURE 4.—(A) Silk tie. Entire dressing, except the exposed portion of tubing, is covered with Scotch tape.

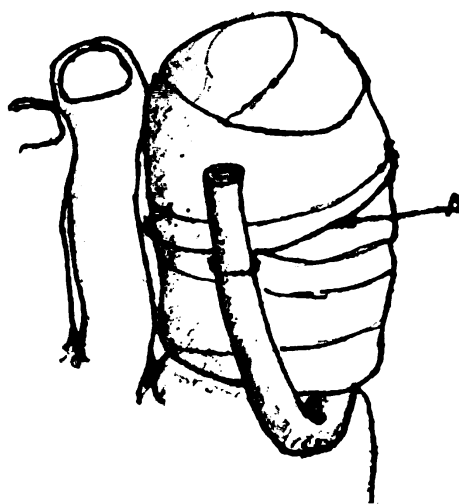


FIGURE 3.—Gauze wick is omitted for clarity of diagram.

bandage scissors along the smooth cellophane tape. An initial dressing sufficiently snug to control bleeding after the tourniquet is removed does not preclude the easy injection of penicillin, though it probably does collapse the tube when it is not being used.

Following operation the men have been kept in bed for one half day, and the wick has been removed after 48 hours. Penicillin injections have been maintained every three or four hours, except from midnight to reveille, for about 3 days. This is followed by daily chloroazodin or half strength hydrogen peroxide soaks for another 3 days with a boric-acid ointment dressing between soaks. Dry sterile dressings are then applied over thymol iodide powder until the wound has healed.

RESULTS

This technique has been used only 4 times but the results have been very impressive. No patient has been off watch over 3 days. The period of postoperative discomfort has only once exceeded 24 hours, and even then was of minimal degree. There has been absolutely no evidence of immediate postoperative infection or edema. One man developed slight redness of the toe with no exudate about 1 week following infection; which was interpreted as evidence of low-grade infection probably planted at the time of redressing. Two of the toes showed frank pus incarcerated under paronychia granulation tissue at the time of operation. At the present time 3 of the operated toes are normal looking and asymptomatic, the fourth is healing cleanly and satisfactorily.

SUMMARY AND COMMENT

The rationale and technique of a method of local application of penicillin in the operative treatment of chronically infected ingrown toenails is described in some detail. It has resulted in a significant reduction in the number of postoperative sick days and virtual elimination of postoperative discomfort on a destroyer at sea, where manpower is constantly at a premium, operative facilities are limited, and discomfort especially trying. The amount of detail included is the direct result of the author's recent confusion, as an inexperienced medical officer on independent duty, in the hope that it will be of help to others on small ships.



THE WARTIME LOG OF A UNITED STATES NAVY HOSPITAL SHIP TO 30 JUNE 1943¹

Part III

RICHARD A. KERN
Commodore (MC) U. S. N. R.

and

MELVILLE J. ASTON
Captain (MC) U. S. N.

The *Medical Service* from 25 May 1942, when Commodore (then Commander) Kern came aboard, admitted 4,061 patients with medical conditions. Of these 3,223 fell into the period during which the ship acted as an evacuating vessel (14 August 1942 to 7 April 1943). The figures do not include patients with burns or wounds who were admitted to medical wards. Of the patients handled during the evacuation period, 3 died: One of malaria, 1 of malaria and black water fever, and 1 of postdiphtheritic respiratory paralysis.

Space does not permit a detailed discussion of experience with these medical cases, but certain points of major interest and importance will be presented.

Malaria was the greatest single medical cause for admission. Between 10 October 1942, when the first patient with malaria was admitted, and the time of writing, these cases totaled 1,148. In 66 of these, the diagnosis was based on clinical findings alone, the blood smears being negative. Plasmodia were found in 1,082 patients. In 408 instances the species of plasmodium could not be identified in the thick smear. *Plasmodium vivax* was found in 377 patients, *Plasmodium falciparum* in 290, *Plasmodium malariae* in 5, and the blood of 2 patients was found to contain both *P. vivax* and *P. falciparum*. In terms of percentage, the recognized species were represented as follows: *P. vivax*, 56 percent, *P. falciparum*, 43.1 percent, and *P. malariae*, 0.9 percent.

Experience has shown, however, that there is one outstanding discrepancy in these figures: There are probably far more mixed infections than they show. This is proved by these facts: In many patients the first organism recognized was *P. vivax*, which has a lower

¹ This is the third of the four parts in which this article is being published. The fourth part will appear in the next issue of the BULLETIN. The list of references will follow the fourth installment.

fever threshold (i. e., fewer parasites cause fever) and produces a clear-cut clinical picture, usually with chills every 48 hours. Then some weeks later the patient had a "recurrence," but this time there were found the unmistakable crescentic gametocytes of *P. falciparum*. Weeks or months later still, the patient again had a relapse, but now there were once more the large ring forms, practically filling the cells, that were obviously those of *P. vivax*. To state it in another way: Given a hundred malaria patients in this area, in their first attacks perhaps a definite majority would be found to have *P. vivax*. A month or 6 weeks later, in the second or third bout of fever, the percentage with *P. falciparum* would be in the majority. But several months still later, especially if the patients had in the meantime been evacuated to a nonmalarial area where reinfection could not take place, those patients with relapses would show a great majority of *vivax* infections, and only very few would show *P. falciparum*. Yet in the records of about half of these late patients now with *vivax* infection, it would be stated that in earlier months *P. falciparum* had been found. In fact, Commodore Kern has been approached by physicians in such evacuation areas who were much troubled by their finding only undoubted *P. vivax* in so many patients who a few months before were alleged to have only undoubted *P. falciparum*. The explanation must be that double infection must have been present at first and the *falciparum* infection, as is usual, was cured sooner than the *vivax* infection. It is a conservative estimate that 10 percent of our patients probably had the double infection.

But it is not clear why in so few instances (a little under 0.3 percent) both types of plasmodia were found, unless it be that one infection dominates the other. The more likely answer is that search of thin smears would disclose double infection if the search were sufficiently prolonged; an impractical measure under wartime conditions.

A clinical observation as to the frequency and severity of involvement of the liver in active malaria has been made the subject of a communication by one of us with Lieutenant Commander Robert F. Norris (MC) U. S. N. R. (5). The report is based on physical findings, studies of liver function by the Van den Bergh test and the bromsulphalein excretion test, and the findings at necropsy in 2 fatal cases.

There were 3 cases of blackwater fever. One of these and another case of *P. falciparum* infection died.

Without going into any details as to the treatment or its results, a few impressions are none the less worth recording. Quinacrine gave results quite as good as did quinine. Unfavorable reactions to quinacrine were encountered less frequently than were those to quinine. We found no evidence of damage resulting from prolonged administration of quinacrine, with possibly a single exception: A patient whose liver

changes found at necropsy might in part have been due to quinacrine given intramuscularly (5).

The prevention of malaria is probably the biggest medical problem in this and certain other war areas, and every suggestion that holds any promise of usefulness toward this end deserves consideration. Therefore we venture to present a small point gleaned from our experience: The lesser incidence of malaria among officers than among enlisted men. During the period of our evacuation service, the ratio of officers to enlisted men among malarial cases was 1:15.5, whereas among all other conditions combined the ratio was 1:11. This could be due to lesser exposure or better suppressive treatment, or both, among officers than among enlisted men. Our evidence suggests that both factors were at work. Officers were more careful as to exposure, not as likely to go stripped to the waist, avoided bathing or any unnecessary exposure at the twilight periods of the day when mosquito flight is greatest, turned in under mosquito bars from dusk to dawn whenever conditions permitted, used mosquito repellent, and took suppressive treatment faithfully. There is only one reason to account for lack of proper observance of these measures: Inadequate knowledge and understanding. There is nothing new about these points, yet if every effort were made to impress all hands with their importance, the incidence of malaria could probably be reduced to a significantly lower level among enlisted men, and possibly among officers as well. But it is hard for an improvident people to learn that even part of a loaf of prevention is better than none.

No one who has served in this area could fail to be impressed with the many and serious problems which malaria raises, both as regards military personnel and operations, as well as the far-reaching effects on the public health at home. We venture to express an opinion on one point in the latter connection: Returning personnel infected with malaria will constitute foci of possible infection for the civilian population. It would therefore seem wise to let malarial patients overcome their infection in an area where there are no anopheline mosquitoes, whenever it is possible so to do.

Acute infectious so-called catarrhal jaundice accounted for 176 admissions. The clinical course was invariably mild, apparently without any permanent hepatic damage, and with complete recovery in all instances. There was no apparent relation to previous immunization against yellow fever. Nor was there found any demonstrable connection with malaria. Neither clinically nor on laboratory study was there any suggestion that any of these cases were of spirochetal origin (Weil's Disease). The clinical impression was that the infection was due to a virus or viruses, and the evidence suggested that the portal of infection was through the digestive tract. How-

ever, the possibility of an insect vector in some cases was by no means ruled out.

The diarrheal diseases were represented by a group of 163 cases. They varied widely in mode of origin, clinical picture, and specific etiologic agent. In each instance the stools were examined microscopically and by culture, and with these results: Infection with *Endamoeba histolytica* was found in 25 patients. Most of these cases had begun with an acute or subacute picture, not severe, lasting a few days and at times with moderate fever. There had been no cases of acute right-lower-quadrant pictures suggesting appendicitis or threatening perforation. When seen by us, most of the patients had had a low-grade intermittent diarrhea for weeks or months. The stools were at times grossly suggestive (blood flecks, mucus) but by no means characteristic. One patient, with little history of diarrhea, had developed right upper abdominal pain, fever, and leukocytosis. He then began to cough. On the day he came aboard his copious brownish sputum was obviously bile-tinged. His amebic abscess had ruptured into the lower lobe of the right lung, producing a secondary lung abscess. Under bronchoscopic drainage and specific treatment with emetine, begun here and continued at the medical facility to which he was transferred, he made a complete recovery.

In 7 cases a bacillary dysentery was proved. These patients usually had in addition to diarrhea a severe illness with marked constitutional symptoms, including a sustained or remittent high fever that lasted from 10 to 14 days.

The remaining 130 cases were a heterogeneous group as to their origins, and mostly mild as regards their constitutional symptoms. Some were short, isolated, sporadic affairs traceable to a single dietary cause. Others occurred in single sharp outbreaks, as for example, when a food-born infection, apparently streptococcal, attacked about 75 men on a carrier, and we received a few overflow cases from her sick bay. An occasional case of *Salmonella* infection was proved. In many instances, a tendency to chronicity and relapse was apparent. In a few cases this was due to gastric achylia.

In nearly all the diarrheal cases there was a clear-cut relationship of the disease to insanitary conditions affecting the food or water supply. The cases were therefore more frequent and more likely to occur in outbreaks in the more advanced areas, during the hotter seasons, and among newly-arrived personnel who had not learned how to safeguard themselves. But one cannot escape the view that very many cases, especially those occurring singly and in well organized areas, were due to carelessness on the part of the individual: Partaking of food and beverages from unauthorized sources. It is hard at times to convince even medical personnel that in the Tropics it is not safe

to eat raw foods that do not grow 3 feet above the ground, and the circumstances of whose cultivation and handling are unknown, or to drink water from untested sources without boiling it.

At this point we mention 1 case each of typhoid fever and of paratyphoid fever, both in men previously vaccinated, both incurred in areas where "off-limits" eating and drinking were prevalent, and both ending in recovery after a mild clinical course. This statement is accepted by the younger generation as a matter of course and without comment. Yet it spells a greater triumph than any that has been won on any battle field. The writers are old enough to remember from their boyhood the broken men that drifted back from the camps in Spanish-American War days, when 1 of every 5 soldiers in the Army got typhoid fever, and 1 in every 66 died of it, more than from all the battle casualties. They remember, too, the prevalence of typhoid fever in civil life in the early days of their medical careers just before the last war. Even in that conflict, typhoid fever, while comparatively rare, was nevertheless seen much more often than now, and paratyphoid fever played no small part in the fiasco at Gallipoli. Therefore, when during 19 months in the Tropics in wartime, and among 10,000 patients admitted largely from battle-torn, primitive islands there occur only a single case of typhoid fever and a single case of paratyphoid, that rates a citation.

There were 38 cases of dengue or a dengue-like disease, atypical in that a double-humped fever curve and severe prostration were unusual. Most of the cases occurred within a few weeks in an area which in the wake of its rainy season was experiencing the first large outbreak in 7 years. A not infrequent symptom was abdominal pain that simulated appendicitis and in one of our patients led to an exploratory laparotomy for supposed appendicitis. His leukocyte count gave the diagnostic clue: 3,200. Several counts under 2,000 were encountered.

Filariasis was the suspected diagnosis in 19 Marines. They had spent 6 or 8 months in Elysia, then gone into action in the Solomons and after weeks or months were evacuated by us. The story in each case was that of an edema in a forearm or leg, or the genitalia, that after some weeks gradually subsided. Examination usually showed enlarged lymph-nodes in the drainage channel for the area (e. g., inguinal, epitrochlear). There was no lasting edema with any suggestion of elephantiasis. In none of the patients were microfilaria found. Some glands were removed by us but no adult worms were found. Yet there seems little doubt that these were instances of an early filariasis, in which the maturation of microfilaria into adult worms in lymph nodes had given rise to an inflammatory adenitis and lymphangitis, sufficient to produce a temporary lymphedema. Apparently in none

of our cases had an adult male and an adult female chanced to develop in the same lymph node and produce microfilaria. The future course of these patients deserves careful observation.

The potential danger of diphtheria in the Tropics was illustrated by 18 such cases. In 13 of them the clinical picture was so mild that the diagnosis had not been suspected and some of the patients not even admitted to the sick list until paralysis of the palatal and pharyngeal muscles set in. One developed paralysis of both phrenic nerves and died. The details of these cases and the problems involved have been recorded (9).

Contagious diseases were uncommon. Mumps, with 34 cases, headed the list, and there were 2 cases each of measles and German measles, 1 of scarlet fever and 7 of cerebrospinal (meningococcal) fever. They were seen only in personnel recently arrived from home or from a large port in a temperate zone. There were no fatalities.

The picture of respiratory infections was interesting, especially when compared with our former experiences on the east coast of the United States. Commodore Kern and Lieutenant Commander Norris reported the bacteriological findings in this group of patients (8). Catarrhal fever among the ship's company was quite common and usually followed in the wake of a visit to an evacuation area outside of the Tropics. Or it occurred in persons recently out from home. But complications such as pneumonia, sinusitis, or even bronchitis were decidedly rare. Thus, among our more than 10,000 patients only 16 had lobar pneumonia, 22 broncho-pneumonia, and 12 a so-called acute pneumonitis. Most of the latter had fever, cough, little or no leukocytosis, few or no physical signs except a few râles, but positive x-ray findings of some patchy, at times confluent, consolidation. These were thought to be due probably to a virus infection. In only 2 patients was a pneumococcus isolated that could be typed (III and VIII respectively). None of these patients was very ill, none required oxygen therapy, all recovered, and the duration of their illness was only a few days. Highly significant with regard to this rarity of pneumonic infections, we feel, is the relative scarcity of pathogenic bacteria in the nose and throat of every one who has been in this area for several months. The virus infections, which initiate the disease in nose, throat, and tracheobronchial tree, apparently of themselves rarely produce serious illness, unless aided and abetted by pathogenic bacteria. One wonders what will happen to us upon our return to the bacterial flora of an east coast winter.

Pulmonary tuberculosis was present in 34 patients, and suspected in 20 whose admission was because of serofibrinous pleurisy. This is a smaller number than would have been met in the days before routine

chest films were made of Navy and Marine Corps personnel before being sent to sea. The value of such a checkup was exemplified in a man whose 35-mm. film had not been read before he was sent to this ship for duty. He had no symptoms when the report caught up with him and so made it possible to bring him under treatment promptly and before he had become a menace to his shipmates.

Rheumatic fever was seen in 25 patients, all of them recent arrivals from home, and most of them with a history of recent respiratory infection. Their clinical course in general was milder than is usually seen in the northeastern states. In 30 cases a diagnosis of acute arthritis had been made. Some of these were probably also rheumatic fever. Of 36 cases of chronic arthritis, practically all gave a history of symptoms beginning elsewhere than in this area. The exceptions were those in which trauma played the chief etiologic role.

Allergic diseases accounted for an important group of admissions, 170 in number if we include the 33 patients with contact dermatitis and dermatitis venenata, and more yet if we knew the allergic cases among the 15 so-called chronic bronchitis, the 4 with bronchiectasis, and the numerous cases of migraine and functional disorders of the digestive tract. This group is important because so large a percentage of these patients had to be evacuated from this area, and most of these in turn, especially the 122 asthmatics, will be permanently unsuited for the service. What is more, in most instances the asthma existed prior to enlistment and should have kept the man out of the service in the first place. If the estimate be correct that an asthmatic veteran will cost the Government about 25,000 dollars, then this group will call for several millions of dollars of the taxpayers' money. A few patients developed their asthma after coming to this area. Their symptoms in nearly all cases were due to extrinsic, usually inhalant, factors, most of which were never clearly identified but appeared to be of the nature of air-borne pollens or molds. Some patients developed their symptoms whenever they were ashore in any of the islands, and were free when aboard ship. This was true whether or not the ship at sea or the island in question was in a battle area. Careful observation and questioning failed to disclose any relationship between the asthma and any neurotic or psychogenic factor. This is all the more significant in view of the great frequency of the psychoneuroses among the patients admitted to this ship. Most of the cases of contact dermatitis and dermatitis venenata began out here, after excessive exposure over several months to the vegetation of the several islands. The remaining allergic cases included 4 hay fever, 6 urticaria, 3 food allergy, 2 anaphylactic reaction to toxoid, and 1 allergic intermittent hydra-arthritis.

There were 116 cases of peptic ulcer, all x-ray positive, 80 of them duodenal and 33 gastric in location. Three of the gastric and 1 of the

duodenal ulcers had perforated. Several had bled at times, but most of them not seriously. That dietary factors played a part in the precipitation of symptoms was undoubtedly true. But in addition there was obvious evidence that nervous tension and psychic factors in relation to battle conditions played a decided role in the etiology of these cases. Here again, the great majority of these patients gave a history of clear-cut ulcer attacks prior to entry into the service or while they were still in the United States. It would therefore have been wise either to reject them or not to send them into a combat area.

Patients with cardiovascular disease were relatively few in number. Only one diagnosis appeared with any frequency, angina pectoris in 20 cases, 7 of whom were suspected of having coronary occlusion, but only 2 of whom had electrocardiographic evidence of that fact. Most of these patients were older men in their forties trying to keep pace with lads in their teens; with rest, their symptoms rapidly improved.

Instances of renal disease, except for infections (pyelitis, pyelonephritis), were quite rare.

Skin diseases were common, accounting for 200 admissions, exclusive of the 33 cases of contact dermatitis and dermatitis venenata. As might be expected in a tropical climate, fungous infection, especially of the feet, headed the list with 90 cases, to which must be added 39 of cellulitis of the feet, probably beginning in a pre-existing dermatophytosis. These were, of course, only the worst of the cases of fungous infection and only a small fraction of the total number in the personnel of the armed forces in the area. The management of these cases is indeed a major problem.

Of some interest are the findings on basal metabolism estimations made in patients to rule in or out suspected thyroid disease, mostly suspected thyrotoxicosis. The findings tended to be lower than might be expected at home. Of 100 consecutive determinations, only 6 exceeded plus 5 percent (plus 31, plus 25, plus 19, plus 19, plus 11, plus 9). Nine ranged between 0 and plus 5, 12 from minus 1 to minus 5 percent, 18 from minus 6 to minus 10 percent, 19 from minus 11 to minus 15 percent, 20 from minus 16 to minus 20 percent, 13 from minus 21 to minus 25 percent, 1 was minus 26 and 1 minus 36 percent. Yet none of the patients showed any clinical manifestation of hypothyroidism. The probable explanation would seem to be in an adjustment to a tropical climate, comparable to the lower level of blood pressure there encountered.

Our observations on a number of shipwrecked persons were not numerous enough to warrant a detailed recital. However, one point is worth mentioning: Those who kept their shoes on had little or no trouble with their feet in spite of prolonged immersion (a group of

28 were adrift 12 days) in a warm sea. But those who discarded their shoes had much trouble that was obviously due chiefly to sunburn.

While burns have been counted in our statistics as surgical cases, their treatment has been a function of the medical service, unless a coexisting major wound or fracture called for admission to another service. This is because burns are most numerous after naval battles, when nearly all admissions are of a surgical nature, and the surgical staff is overwhelmed with cases requiring surgical measures. Thus, after one naval engagement we received 366 patients of whom only 33 had medical conditions, but there were over 50 cases of burns. Moreover, burned patients present problems of a physiological nature that fit well into the province of internal medicine.

We have had 360 patients with burns due to nearly every cause except vesicant war gases and treated by various methods. There were only 3 deaths in the group, only one of which was due to burns alone, one to shock from coexisting wounds, and one to sepsis in which a serious shrapnel wound played a part. Our experiences have been reported (6) and certain of our conclusions are here presented.

Since burned patients die, not of their burns but usually of shock, toxemia, or sepsis, the first care is to prevent or to treat these complications. Pressure dressings with elastic bandages can prevent to some degree the development of edema as well as reduce existing edema, and so lessen the occurrence and severity of shock. The frequency with which such pressure dressings are applicable is shown by the fact that of 360 burned patients 333 had some involvement of an extremity. Shock must be treated by intravenous plasma in adequate amounts as determined by frequent hemoglobin estimations. The first dose of morphine should not be over $\frac{1}{2}$ grain and each subsequent dose not over $\frac{1}{4}$ grain, and each dose must be recorded on a tag attached to the patient. Toxemia is best prevented and treated by an adequate but not excessive fluid intake (about 4 liters) and salt by mouth, or if necessary, by vein, 5 to 10 grams a day if check by chemical analysis is not available. The first measure to be used against infection is an aseptic technique in dressing burn patients, including the masking of attendant personnel.

The first step in the local treatment is the preparation of the burned area by cleaning with plain soap and water after removing fuel oil with mineral oil and sterile cotton waste, and then a *minimal* debridement.

The method of local treatment best suited to naval conditions is one that is applicable to all parts of the body, to patients with coexisting wounds and fractures (true of 73 of our cases), and both in the primary treatment of an uninfected burn and the later treatment of an infected burn and of a burn that must be prepared for skin grafting.

A number of current methods do not fulfill one or more of these conditions, notably tannic acid, paraffin wax, and triple dye. Thus, tannic acid should not be used on the face, ears, or hands, parts that were involved in 291 of our cases. None of the methods mentioned is applicable in the treatment of an infected burn, the preparation of a burned area for grafting, or in burns complicated by wounds or fractures.

Sulfathiazole, either in 3-percent ointment with a water-soluble base for uninfected cases, or as a dusting powder, preferably in the micro-crystalline form, with wet saline dressings for face burns or infected burns, was found to meet all these conditions. Initial dressings should be left in place for 10 to 14 days unless infection calls for a change of dressing. Skin grafting should be done early to prevent scar formation.

Many burns could be prevented in naval actions by attention to full clothing at battle stations, the use of fire-proofed antifiash gear, and the constant availability of gloves, worn by those whose efficiency would not be reduced thereby and carried by the rest for possible use in case of fire or sliding down ropes, since burns of the hands cause the longest periods of disability.

Neuropsychiatric and neurological disabilities accounted for over 900 admissions. Of these, 751 occurred during the evacuation period and were largely incident to the first campaign in the Solomons. Of these 751 patients, 75 (10 percent) were psychotics, 487 had definite neuroses, 19 had epilepsy, and in 165 the diagnoses included nerve injuries, neuritis, neuralgia, neoplasms, migraine, Ménière's syndrome and headache. In the latter number there were many whose trouble was fundamentally on a neurotic basis. Moreover, many patients on board under a diagnosis of somatic disease were really the victims of a psychoneurosis. It is therefore conservative to say that 10 percent of the patients handled during the evacuation period were psychoneurotics. From the observations of this group made by Lieutenant Commander Dana L. Farnsworth (MC) U. S. N. R. certain points are offered.

During periods of relatively slight stress, such as before and after the Solomons campaign, the admissions to the neuropsychiatric service differed in no significant degree from those of peacetime, except for a moderate relative increase in the number of psychoneuroses as compared with the constitutional psychopathic states and the psychoses. However, during the height of the action in the Solomon Islands a fairly characteristic group of patients appeared, with a symptom complex indicating an exaggerated or overwhelming fear reaction, coupled with varying degrees of trauma by blast to the entire nervous system. This group of patients numbered about 300.

The main symptoms in this group were headaches, marked sensitivity to noises, terrifying or disturbing dreams, insomnia, tinnitus, dizziness, loss of emotional control (crying spells were especially frequent), amnesia and trance-like states lasting from a few minutes to 8 days, slow speech or stammering, and cerebral retardation. On the wards these patients jumped violently at the slightest unusual sound, and terror-stricken episodes resulting from dreams were common throughout the night.

Common physical findings were generalized hyperreflexia, tremors of hands and face, sometimes of the whole body, and an appearance and manner resembling that of an old man. Less frequent findings were slight hypertension, tachycardia, and dilation of pupils.

These patients formed the most interesting and valuable group for study, and for a number of reasons. They were the most amenable to treatment and even a few days on the ship under favorable living conditions seemed to bring about a considerable improvement in their condition. A fair proportion of them will be able to rehabilitate themselves for effective participation in civil life, while a small proportion will be able to return for duty.

The experiences of a captain of Marines is fairly typical of those of these cases. For about 7 weeks after 7 August 1942, when he first landed on Guadalcanal, he was able to carry out his duties in his usual manner. Then a 1,000-pound bomb exploded about 75 yards away, which scared him for a while, but he was able to forget it shortly and even to tolerate shellings from naval craft without much reaction. About a week before admission, many bombs were dropped on his area and three or four exploded over his dugout, one no more than 6 feet from him. He vaguely remembered dirt and debris falling on him, and his trying to help some of his men out, three of whom "gave out" completely. From then on he could not bear to look at his men, he felt he had lost his nerve, and when guns were fired he had to hide his face. He tried to convince himself he was all right, he worried over sending his men out on patrol duty, he tried to avoid them so that they might not learn of his fear, and he was afraid to go out of his tent, particularly after a delayed-action bomb exploded nearby. Finally, after 2 days of near-panic, his medical officer approached him and said "I've been noticing you," and immediately he "broke down and cried like a 2-year old." He was admitted to the hospital, but that night there was an all-night alert, and he became more tense. He worried over leaving his men, considered himself a coward, and when he dropped off to sleep, would dream of a bombing attack and wake again. No member of his family had had any nervous symptoms, nor had he previously. His physical examination was essentially negative. It was felt that he would be unable to do combat duty for several

months, but that he probably would do so later, since he showed evidences of rapid improvement.

Most of the hazards of peacetime were of course present to cause the potential neurotic to break down, and in addition there were many peculiar to war. By far the most important one was the strain of continual bombings by air and shelling by surface craft. When a shelling was combined with the play of searchlights on the positions occupied by the men under fire, the strain became quite unbearable to many, and acute symptoms, a combination of hysteria and anxiety forms, resulted. The loss of close friends, the sight of mangled bodies of our own men, the fatigue due to broken sleep and excessive exertion, poor and insufficient food, all these were important and often all present in the same case. The incidence of neurotic reactions was low during the early weeks, but rose sharply after the men had been on continuous hazardous duty for 4 to 6 weeks.

It is Lieutenant Commander Farnsworth's opinion, in which we heartily concur, that it could not be too strongly urged that the sooner the patients suffering marked anxiety reactions are returned to civil life, or to duty in a noncombat area, the larger will be the percentage of successful rehabilitation. Prolonged illness in a hospital tends to fix the nervous symptoms, so that psychotherapy is of little value, and even spontaneous improvement is made difficult. Reeducation procedures therefore should be carried out as soon as possible.

Among the psychotic patients, dementia praecox accounted for 36, manic depressive psychosis for 23, and the rest were either exhaustion psychoses, paranoid states, or unclassified. Their management on shipboard offered somewhat greater difficulties than ashore, but no patient caused any undue amount of trouble. The impression was that the incidence of psychoses tended to vary directly with the number of patients admitted, rather than with the intensity of operations in the combat area. Their incidence was particularly low in the casualties from sea battles. Long-continued strain in susceptible individuals seemed to be the outstanding factor in their illness.

To say that from the date of commissioning to 30 June 1943 there were performed 49,786 examinations in the laboratory, gives a wholly inadequate picture of the important activities of this department. It becomes more significant when one adds that this represents an average of nearly 5 examinations for every patient admitted, but it still does not give any idea of the wide range of procedures carried out, unless the reader bears in mind the possibilities offered by the wide range of diseases represented by our patients, especially the large number of infections and parasitic conditions and their diagnostic demands upon the laboratory. And the work was done by a

small staff in a single room with a deck area of only 394 square feet, the least adequate space for its purpose anywhere in the ship.

The work of the Dental Department, since 7 December 1941, has almost run the gamut of the dental procedures and diagnoses listed in the Report of Dental Operations and Treatment. There have been 56 cases of fractured jaw that were splinted on board this ship. Several of these were seriously wounded, so that the surgeons collaborated with the dental officer in securing satisfactory results. One obturator was made, which permitted the patient to resume normal speech and eating habits. In 2 instances the body of the mandible had to be removed, the patients did well and when last seen were awaiting prosthetic appliances. More than 1,800 amalgam restorations were made, over 600 silicates (synthetic porcelains), and a few gold inlays. Teeth were conserved with pulp extirpation and root canal therapy when time permitted. Over 450 teeth were removed, in many instances involving the surgical removal of an impacted tooth. Third-molar problems were frequent because of the youthfulness of most of our patients. Vincent's infection, gingivitis, and pyorrhea were frequently encountered and treated. More than 500 prophylactic treatments were performed. The most important service rendered by the department was in the field of prosthetics. There were made over 75 full upper and lower and over 125 partial upper and lower restorations. There were also constructed 30 fixed bridges, a few gold and 15 porcelain-jacket crowns. These figures are more significant if it be remembered that for 2 months there was only one dentist on board and during one of those months he was on the sick list.

During the past 11 months the ship has been fortunate in having the services of an artist, M. J. Hadden, pharmacist's mate, first class, U. S. N., who has made a series of watercolor paintings of representative cases of war wounds, compound fractures, lesions of the eye, and burns. Seventy-five such illustrations have been sent to the U. S. Naval Medical School where they can serve for teaching purposes, as well as permanent records of medical and historical interest.

At this point we wish to record the fact that beginning with 25 May 1942, 11 of the 12 medical officers and 1 of the 2 dentists then aboard were members of Naval Medical Specialist Unit No. 31. The unit was organized in 1935 at the University of Pennsylvania by Commodore Kern and was called to active duty on 2 February 1942. The organizer of the unit served during the last war as a member of the Medical Corps, U. S. Navy, on board the U. S. S. *Solace*. The unit members, as well as all of the senior medical officer's staff during the period of his duty in this vessel have performed their duties in accordance with the highest standards of medical practice and the traditions of the Medical Corps of the Navy.

It is our privilege to testify to the splendid work done on board by the members of the Navy Nurse Corps and of the Nurse Corps Reserve. Time was, when there were those who seriously questioned the advisability of sending nurses to sea. Their professional skill, their ability to guide and instruct the enlisted members of the Hospital Corps in the care of the sick and wounded, their qualities of leadership in directing the nursing activities in operating room, wards, and clinics, and above all, their tact and good judgment in meeting and solving the innumerable professional and social problems of their duties at sea, have amply refuted every objection to such duty for nurses. Nor were these problems always easy to solve, especially with regard to the numerous attempts to entertain them, attempts that were the more enthusiastic the more advanced the area which the ship visited. On one occasion a young aviator tried six times to drop a note on the fan tail as the ship was making port, with a hope of stealing a march on his rivals.

Previous to 16 December 1942, our complement of nurses was 1 chief nurse and only 12 duty nurses. This meant that with a ship filled with patients (on one trip there were 513 on board, most them requiring considerable nursing care) there would not have been sufficient nurses to supervise the various wards and clinics. During several evacuations, therefore, the senior Army medical officer at one of the bases came to our aid and detailed a group of Army nurses to make the trips, who in turn had their first opportunity to take part in the care of battle casualties. Their excellent work was greatly appreciated.

It is difficult to put in words a fitting tribute to the Hospital Corps and to the ship's company as a whole, the commanding officer, executive officer, officers, and enlisted men, for their lion's share in the successful functioning of this vessel. Perhaps they will understand all the depth of feeling of gratitude and praise that goes into a sailor's words, "Well done." By their tireless efforts and their loyal, cheerful cooperation they have achieved that byproduct of efficiency, a happy ship.

The *Solace*, herself, of course, merits our praise and affection. A converted merchant ship, she nevertheless shows evidence of such careful planning, that the visitor on being shown the ship remarks that of course she must have been built as a hospital ship. Her equipment, gathered and installed in the happy days before priorities, has been our pride and joy, and the envy of all others. To be sure, she has her faults. But then, who hasn't? So, for example, she acts a bit skittish in the slightest blow, when her low metacentric height and her deep state of ballast combine to cause a roll with a very short period for the size of the ship. It was lucky that the worst storm was encountered on the way back from an evacuation when there were

no patients on board, when at 2 in the morning she flipped blithely from 26 degrees to starboard to 24 to port, and proved that a lot of things really hadn't been secured for sea, including the pots and pans in the commanding officer's pantry that went hurtling up and down the passageways of the wardroom country. But then she is a lucky ship. She proved that at Pearl Harbor, and on occasions thereafter, such as the chance-meeting with a stranger off the north coast of Elysia; or the nice precision with which she made and left a certain port just hours after the last, and a scant hour before, the next attack from air or sea; or her meeting with the searchers after the Golden Fleece, or her midnight tryst with a nameless inimical friend. But one really can't tell much about these things, and the censor is getting nervous, so it is better to change the subject.



STIMULATING ACTION OF ACETYLCHOLINE ON THE HEART

Author's summary.—1. It is shown that acetylcholine can, in certain circumstances, stimulate the heart. This occurs when it is administered in small doses to suitable hearts or at the commencement of the action of large doses or, with large doses, if the better known inhibiting action of the substance is abolished by atropine or methylene blue.

2. The stimulating action is enhanced by eserine after atropine, but may be abolished by ergotoxine or large doses of atropine.

3. The stimulating action is seen after the administration of nicotine in sufficient dosage to paralyse autonomic ganglia and if the ventricular muscle is driven electrically. It therefore appears to be a direct action on the cardiac muscle.

4. The effect, compared with that of adrenaline, is more on the force of the heart than on the frequency. The possible significance of these facts in the intact animal is discussed.

Note added in proof.—Since this paper was submitted, a paper by Hoffmann, Middleton & Talesnik (*Amer. J. Physiol* (1945), 144, 189) has appeared confirming the main results and adding the observation that the stimulating action of acetylcholine is abolished by curare and is accompanied by a release of adrenaline into the coronary outflow. * * *—McDOWALL, R. J. S.: Stimulating action of acetylcholine on the heart. *J. Physiol.* 104: 392-403, April 1946.

THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION
OF THE PHYSICIAN—Hippocrates

EDITORIALS



NEW PUBLICATION DATES OF THE UNITED STATES NAVAL MEDICAL BULLETIN

With this number the United States Naval Medical Bulletin becomes a bimonthly publication. The publication dates for 1947 are:

January–February number.....	February 10
March–April number.....	March 20
May–June number.....	May 20
July–August number.....	July 20
September–October number.....	September 20
November–December number.....	November 20

The change to publication every 2 months has been necessitated by reduction in appropriations for printing and binding. The volume of professional and scientific articles remains large as the numerous valuable lessons and experiences of the war are recorded by our medical and dental officers for publication, and it is believed that it will be possible to publish all important articles submitted on general and naval medicine.

The Bumed News Letter will continue publication twice monthly and thus notes on new developments can be made rapidly available to members of the Medical Department.

The Hospital Corps Quarterly which, during the war years, was printed monthly, has now returned to quarterly publication. As always, emphasis is given to training material and to practical features of value to the hospital corpsman in his duties, and aimed toward the improvement of his professional knowledge and interest.



GRADUATE TRAINING IN THE NAVY MEDICAL CORPS

Graduate medical training in the Navy consists of (a) internships, (b) residency training, (c) continuation courses, and (d) special courses.

Approval of naval hospitals for internship training is based upon standards of and action by the Council on Medical Education and Hospitals of the American Medical Association.

Approval of residency training in naval hospitals in medical and surgical specialties is based upon standards of and action by the Council on Medical Education and Hospitals of the American Medical Association and the American Specialty Boards acting jointly, and additional approval for graduate training in the surgical specialties only is based upon standards of and action by the American College of Surgeons.

At the present time over 200 residencies in various specialties are available in naval hospitals. As of 1 November 1946, 124 of the available residencies had been filled. The remainder will be filled as rapidly as possible.

As far as practicable, medical officers just completing a tour of sea duty or duty beyond the continental limits of the United States are most eligible for these appointments.

Approval of residency training in naval hospitals is in most instances for limited periods of time, such as one or two years of the total experience necessary for qualification for the American Boards or for the accumulation of credits for the American Colleges. Unless an officer is on duty in a hospital in a specialty with unlimited approval, his training must be supplemented by further training in the same specialty at another institution, naval or civilian, in order to meet the Board or College requirements. Such courses are spoken of as continuation courses.

Special courses for instruction in lines of work peculiar to the Navy are well known. These include such courses as aviation medicine, submarine medicine, public health, industrial medicine, tropical medicine, research, and medical aspects of radiation.



ASCORBIC ACID IN THE PREVENTION AND TREATMENT OF DISEASE

As far back as Elizabethan times "the juice of limmons" was known to be a specific against scurvy although it was not until more than 200 years later that the use of it was made mandatory in the British Navy in which scurvy at once almost ceased to exist.

Citric acid or ascorbic acid, as it is now generally called, was isolated scarcely 15 years ago. Since then its structure and methods of synthesis have become known and identification tests developed. In structure, it is closely related to the monosaccharides, such as glucose and fructose. Its value in pneumonia and indeed in all infections, particularly of the upper respiratory tract, seem connected with its chemical structure.

Studies have indicated that the absence of sufficient ascorbic acid in the diet is not only the cause of one important deficiency disease, scurvy, but is also an adjunct in maintaining nutrition with other vitamins. In fact, there is evidence that all the vitamins are mutually dependent in keeping nutrition and disease resistance at a proper level.

Great importance attaches to rapid and accurate methods of determining the ascorbic-acid content of foods and many new and practical tests have been found. This has resulted in a careful survey of foods with determinations of their ascorbic-acid content. Also there have been many studies of the decline of this content in foods in storage, and in canning, drying, freezing, or similar preservative processes. It is of importance that ascorbic acid is one vitamin of which much loss occurs in cooking and processing for storage. Light, air, the presence of heavy metals, and many enzymes of plants all cause deterioration. This is lessened or prevented in the presence of acids.

A subject of extensive study has been the ascorbic-acid requirement of man. Despite the large amount of work on this problem it is still in a controversial stage. At first 25 milligrams a day or about the amount in 1 ounce of orange juice was considered an adequate daily intake. With studies based on serum levels, The National Research Council recommended 75 milligrams for adults, 30 to 75 milligrams daily for children up to 12 years, and 100 to 150 milligrams in pregnancy and lactation. These amounts are aimed at producing a maximum tissue concentration. The minimum amount of 25 milligrams to prevent the appearance of endemic scurvy still stands. But the amounts needed to lessen gingivitis, carry on detoxifying effects, and produce preventive or therapeutic results are by no means determined and offer a fruitful field for investigation. Nor have all the methods of testing for the presence of ascorbic acid been described and here, also, there is opportunity for new methods to be devised.



PHYSICAL DEFECTS FOUND IN DRAFTED MEN IN THE UNITED STATES IN WORLD WARS I AND II

From time to time statements appear that reflect alarm over the physical condition and health of the general population as a result of defects found during the physical examination of selective service registrants. It is of interest therefore to examine the reports on the physical condition of draftees in both World War I and World War II. Extensive statistics and reports have been prepared and made available on the subject. The "Defects Found in Drafted Men," published by the War Department after World War I is a massive volume containing an enormous amount of data. Recently, the National Headquarters of the Selective Service System, Washington, has, in Medical Statistics Bulletin No. 3, printed an analysis of reports for the Continental United States on the physical examination of registrants from April 1942 to December 1943.

There are many pitfalls to be avoided in dealing with these statistics. In the first place, the physical condition of the populace as a whole is by no means as bad as it is sometimes pictured. The physical standards for the military service lead to numerous rejections which are not actually defects of health. Thus a certain height is required. Many nationalities and races, however, have short stature as a national or racial characteristic, and it is a defect only in a military sense. Numerous defects unfitting for military service do not prevent a person from satisfactorily earning a living in civil life, or enjoying a long and healthy existence.

Statistics also vary greatly due to changes in physical standards. Increasing the visual requirements by only a small amount greatly increases the rejections for defective eyesight. Visual standards were usually high and many men with fairly good eyesight were unfit for certain types of military service. The difference in standards also makes comparisons between the rejections from physical causes in World War I and World War II difficult.

The 10 leading causes for rejection from April 1943 to December 1943 were:

	<i>Percent</i>		<i>Percent</i>
Mental diseases.....	17.9	Ears	4.7
Mental deficiency.....	14.2	Syphilis	3.7
Musculoskeletal defects.....	8.9	Nonmedical	3.3
Cardiovascular	7.0		
Eyes	6.3	Total.....	71.0
Neurological conditions.....	5.0		

These constituted 71 percent, all other causes making up 29 percent.

When white and colored inductees were compared, mental disease (14.2 percent) was the leading cause for rejection in the former and syphilis (30.4 percent) for the latter.

In contrasting these findings with the defects found in drafted men in World War I some very striking differences are found. Flatfoot, constituting 12 percent of all causes for rejection, led the list in World War I. Hernia was second. Defects of vision were third. Hernia and flat feet were grouped under one head in the statistics as mechanical defects. Defective physical development was also a large group. This contained men below the standards set for height and weight and chest expansion. It was felt afterwards that the standards set were too high and not enough consideration had been given to the lowering of height and weight in the population by the immigration from countries in which the stature was smaller than in the native American stock.

Organic disease of the heart was important in both groups of statistics and the crippling effects of certain infectious diseases such as the streptococcal diseases, rheumatic fever, scarlet fever, and sore throat were indicated by the physical examination in both wars. The same can be said of syphilis as an etiological agent in cardiovascular conditions. Much can be expected from early treatment of these conditions and the development of antibiotics. There is less promise of any great reduction in many of the other conditions, though all present a challenge to the medical profession.



ADVANCES IN MEDICINE AND THE MEDICAL SCIENCES DURING 1946¹



INTRODUCTION

The following is a brief résumé or calendar of the more important advances in the clinical branches of medicine, as well as the medical sciences, in 1946. Only the most outstanding events are mentioned and, as far as possible, limited to advances made in 1946, though this latter purpose cannot always be realized as the original work may have been done on a subject in previous years and brought to a final and successful conclusion in the past year. Of course, it is also obvious that when discoveries so recent have to be appraised without the results of long use which time alone can give, errors of commission or omission may naturally result.

Before proceeding to the lists of advances in each field, it is of interest to bring forward the one or two general developments which overshadow all others and represent the most significant and striking features of medical progress during the year. They are of particular interest for this year, as 1946 is a remarkable one in the history of medicine. There are at least two advances likely to have revolutionary and far-reaching effects. The first of these is the use of radioactive isotopes in medicine and the biological sciences for research and in the diagnosis and treatment of disease; the second is the discovery and further development of numerous antibiotic substances from both the plant and animal world for use as therapeutic agents. Plant and animal extracts are being used for such diverse purposes as bactericides, the inhibition of cancer, and the prolongation of cell and organ activity. We appear to be at the threshold of a new therapeutic era.

Eminent specialists in each specialty have been consulted regarding what they consider the outstanding advances in their specialties and grateful acknowledgment is made for their assistance. This sense of obligation has also been given in personal correspondence with the consultants.

¹ This section has been prepared after consultation with leaders in each of the specialties concerned. The difficulty of making final appraisals so close to the event must be appreciated, and, furthermore, variation in individual judgment must be accepted. The names of those who made suggestions and contributions are listed in the section on contributors on pages 208 and 209 of this issue.

MEDICINE

1. The use of radioactive isotopes in the diagnosis and treatment of disease is perhaps the most epoch-making advance to record. The first most successful use is that of radioactive phosphorous in the treatment of polycythemia vera. The principle of placing radioactive isotopes where they can emit radiation upon the tissue desired and amount needed is the important feature. Much research is required, however, to standardize the treatment and to discover idiosyncrasies, ill effects, contraindications, and comparison with other methods of treatment. The possibilities as to the treatment of the blood dyscrasias and also malignancy, however, are very great. At present, radioactive phosphorous ranks with x-ray in the treatment of certain types of myelogenous and lymphatic leukemias. However, Hodgkin's disease, lymphosarcoma, multiple myeloma, and very acute lymphatic anemias with striking bone marrow changes do not respond as favorably as to x-ray therapy. With increased research with radioactive isotopes, new developments are certain.

2. The general study of antibiotic substances from leaves and other plant parts, the original impetus to which was given by the discovery of penicillin, streptomycin, and antibiotics obtained from molds.

3. Extension of the use of streptomycin and further clinical appraisal is a feature of 1946 medicine.

4. Extension of the use of thiouracil and the development and use of propylthiouracil in hyperthyroidism. The new drug is apparently an advance over thiouracil. There appears to be no serious ill results from prolonged use. If hypothyroidism is induced, it disappears with reduced dosage.

5. Folic acid as a preventive and curative agent in sprue and macrocytic anemias. This is another fundamental discovery of the year.

6. The development of knowledge of the constitution of penicillin and the fact that various fractions are more potent than others is an important advance of 1946. That penicillin is a complex substance is now evident and studies are being continued to determine its various components and their effects.

7. The electrokymograph is an instrument less revolutionary than the electrocardiograph, but is nevertheless an important addition to the armamentarium of the cardiologist. Though devised earlier, full recognition of its value may be put among the medical achievements of 1946. This instrument records the movements of the heart border by changing the x-ray shadow to a tracing on standard electrocardiographic paper through the string of an electrocardiograph.

8. The use of nitrogen mustard therapy in Hodgkin's disease, leukemia, and lymphosarcoma is one of the promising developments of the year. If highly successful, it furnishes a perfect supplement to the treatment of the macrocytic anemias with folic acid.

9. Further developments in anti-coagulant therapy and the extension of it to additional fields, including both coronary and cerebral thrombosis.

10. Realization that pulmonary calcification, at least some of it, is related to past infections of a benign form of histoplasmosis or some other biologically related infection.

11. Further extension of the use of amino-acid therapy (both parenterally and orally) in the wasting diseases and depleted states both of acute and chronic types. This is an extension of the previously realized field for amino-acid therapy in such conditions as hepatic cirrhosis, nephrosis, ulcerative colitis, and peptic ulcer.

12. Development of penicillin-aerosol therapy in certain respiratory infections, notably in suppurative bronchopulmonary conditions.

13. The development of new antihistamine preparations, such as pyrabenzamine for the treatment of nasal allergy and to a lesser degree urticaria. Though relatively ineffective in asthma, some favorable results are reported.

14. The culmination of several years of study has led to the tentative conclusion that the most important advance in the treatment of leprosy has been reached since the extensive use of chaulmoolgra oil was begun. The new treatment is the use of not one, but several drugs together, particularly promin, diasone, and streptomycin. Most of this work has been done at the U. S. Public Health Leprosarium at Carville, Louisiana. While too early to fully evaluate, this is the most promising of attempts at a definitive treatment of leprosy up to the present time.

15. Rickettsialpox, a newly identified type of rickettsial disease, has been proved to be carried by mice and mites. Mice appear to be the regular carrier, and the mite the vector that transmits the disease to man.

16. Among developments of 1946 is evidence that antibody production and function is closely related to the ingestion of adequate amounts of amino-acids.

17. This is not only the centenary year of the discovery of anesthesia but it is the quarter-century mark of the discovery of insulin. One of the greatest advances in the history of therapeutics, its clinical use was begun in the fall of 1921.

TROPICAL MEDICINE

1. An effective drug for the treatment of trypanosomiasis, or African sleeping sickness, has been developed at Johns Hopkins Hospital by a venereal disease research group and tested in the areas of equatorial Africa where the disease is most prevalent. This drug is an arsenical, p-arsenosphenol butyric acid.

2. The advance in the treatment of cholera by the use of sulfonamides and penicillin in conjunction with salines and blood plasma also was done mostly during the war years but its full publication and use was in 1946. Blood plasma in cases where hemoconcentration was great and the patient practically moribund was strikingly effective in restoring the circulation so that salines and penicillin and sulfadiazine could act.

3. Continuance of research in the development of synthetic anti-malarial substances which would be an improvement upon quinacrine (atabrine), the first of these important synthetic organic drugs. Chloroquin and oxychloroquin, and some others still under investigation show great possibilities. In Great Britain a new antimalarial, paludrine, is one of the most promising of these drugs. The ion exchange process for the extraction of cinchona alkaloids is another great advance in the production of quinine. Though developed during the war years, the publication and spread of information about it was largely in 1946.

4. At the end of 1946 it is of importance that fears of the widespread introduction and dissemination of tropical diseases by returning servicemen has not materialized. Infectious hepatitis due to a jaundice producing virus is about the only exception. The principal danger here is in the therapeutic use of blood which may be infected with the virus. The medical profession is aware of this and precautions and safeguards are already being developed or being used.

NAVAL MEDICINE

1. Important basic research was done on men highly susceptible to spread introduction and dissemination of tropical diseases by returnability to motion sickness by a questionnaire method was made.

2. Development of methods of determining local and over-all insulation of clothing as a protection against low temperatures. This permits evaluation of the efficiency of a garment over certain areas such as the shoulders, hands, feet, or other places particularly susceptible to cold.

3. Careful physiological observations were made on men making a short cruise in tropical waters from a port in the temperate zone. Various physiological stresses were recorded.

4. The Bureau of Ships directed installation of thermostatic switches in all dishwashing machines where these are now lacking or out of repair. These switches will shut off the machine if the temperature of the dishwater falls below the desired 180° F.

AVIATION MEDICINE

1. A review of the basic physical factors in the pathogenesis of aeroembolism, including the mathematical principles involved in bub-

ble formation, gas solubilities, and decompression rates was made which provides much fundamental information including comparison of decompression from high pressures and altitude.

2. Important study and research was carried out on the principles of protection of the human body as applied to a restraining harness for aircraft pilots.

3. During the year, in what was spoken of as "Operation Everest," an extensive study of the physiological effects of altitude was made. Here the changes parallel to those in mountain ascents were made with every facility available and the observers themselves not affected by the conditions they were attempting to study and record.

NEUROPSYCHIATRY

1. During 1946 an analysis of statistics of Selective Service shows that neuropsychiatric conditions of all types were among the principal causes of rejection for inductees, and mental deficiency (which included educational deficiency) was frequently found. In addition, large numbers of men were discharged after enlistment with the diagnosis of psychoneurosis. Thus it became obvious that one of the most important segments of illness in the country is in the field of mental health.

2. As a corollary of this, the number of psychiatrists was inadequate and the need for physicians in this specialty is apparent.

3. In part, as a consequence of the shortage of psychiatrists, group therapy has received a considerable impetus so that a larger number of patients may be treated by a limited number of specialists.

4. Further evaluation of some drugs already in use in epilepsy and the introduction of at least one other, 3-methyl 5,5-phenyl-ethylhydantoin (phenantoin), which shows promise on early clinical trial.

SURGERY

1. Development of an oxidized cellulose gauze absorbed in alkaline media which can be used as a surgical sponge and if not removed will absorb without harm to the patient.

2. Development of a suction socket and hydraulic mechanism for artificial limbs has been brought to light during this year, though most of the work along this line of research had been done in Germany during the war.

3. Emphasis on the prevention of thrombosis and embolism continues in surgery in 1946. Early ambulation and the use of dicoumarol and in certain types of cases femoral vein interruption are the principal developments.

4. A simple but valuable diagnostic test for thenar space abscess is described in the American Journal of Surgery (October 1946). It consists of placing a small object such as a match stick with one

end against the index finger and the other end against the thumb. Adduction of the thumb against this resistance results in pain in the base of the thumb if the adductor pollicis is overlain with pus.

5. Improvements in thoracic surgery include advances in the more radical procedures for pulmonary tuberculosis and nonspecific abscesses of the lung; also in the transthoracic approach to malignant lesions of the lower esophagus and cardiac end of the stomach which has resulted in the extirpation of the lesion in many cases when the abdominal approach was unsatisfactory.

6. In postoperative care improvements and advances have been made in the application of antibiotic agents.

7. Vagotomy at the level of the hiatus oesophagus in the treatment of peptic, duodenal, and marginal ulcer.

8. Chemotherapy in surgery has received further and welcome study, and excellent reports on further work with the sulfonamides, penicillin, streptomycin, and tyrothrycin have been elaborated. (The latter, incidentally, has been shown to be most effective in hemolytic streptococcal infections, with staphylococcus aureus and albus next. It is ineffective when the preponderant organisms are gram-negative.) With regard to streptomycin, Murphy and his co-workers seem to be somewhat disappointed in the relatively narrow range of application in mixed infections such as peritonitis. The volume of reports on streptomycin, in general, is not large at this time, and it may be said that to date, it has a wider application in the medical diseases than in the field of surgery.

9. Two important advances in vascular surgery are the operations for the relief of the tetrad of Fallot and for ductus arteriosus and coarctation of the aorta. No surgeon, whatever his special interest, should fail to read Blalock's article on "The Surgical Treatment of Congenital Pulmonic Stenosis." The adjectives to describe this work—monumental, incredible, amazing, and the like—are more apt to be found in a Hollywood trade journal than in the pages of the NAVAL MEDICAL BULLETIN. Nevertheless, to describe this work, one must needs resort to them.

10. Additional contributions to the literature of burns are found, as well as discussions of such diverse topics as the surgical treatment of plantar warts, further refinements in the tests and operations for varicose veins, early postoperative ambulation, and new instruments and techniques in bowel and biliary tract surgery.

NEUROSURGERY

1. The extensive use of fibrin foam, gel foam, and thrombin, for the control of intracranial and intraspinal hemorrhage has been one of the advances in neurosurgery in 1946.

2. The use of serum albumin in the treatment of cerebral edema either due to trauma or following removal of intracranial tumors was found of value during the war and is now becoming extensively used with definite success.

3. The year of 1946 saw the further evaluation of penicillin in intracranial infections and abscesses and osteomyelitis of the skull. Its great value has been further confirmed in the preoperative and post-operative management of these cases and has reduced the mortality and morbidity.

4. The use of tantalum sutures has become accepted as equal to or even superior to silk or cotton in skin closure.

OBSTETRICS AND GYNECOLOGY

1. Increased use of the vaginal smear in gynecological diagnosis, including ovulation, pregnancy, and malignancy.

2. The second case of distal ectopic pregnancy with implantation in the uterine cervix to be described in American medical literature was reprinted in 1946.

3. Selection between the use of sulfa-derivatives, penicillin, and streptomycin as appropriate treatment for various types of infection during pregnancy and the puerperium became quite clearly defined during 1946. Streptomycin had been available to the Navy and to the Army but it was not until September 1946, that it reached civilian distribution.

4. Penicillin either displaced or was used to augment sulfa-derivatives because of its generally greater effectiveness, with fewer ill side-effects; both preparations of these were comparatively ineffective against infections resulting from certain organisms, notably gram-negative bacilli. Streptomycin is to be chosen, therefore, for use in such infections. It appears to be especially valuable during pregnancy in pyelitis with colon bacilli predominating; the results confidently expected from its use for this condition have been, however, to some extent disappointing.

5. Fibrin-foam, a recent by-product of serum albumin, has been found useful in gynecologic operations where oozing from broad areas of separated adhesions must be controlled.

6. More current information on the subject of Rh incompatibilities and their relation to erythroblastosis of the newborn has resulted in general establishment of routine Rh tests on mothers' blood early in pregnancy. This had been an established procedure in family dependent clinics of naval hospitals for at least 3 years.

7. Since the ending of hostilities in 1945, it has been estimated that the Medical Corps of the U. S. Navy attended during the war years approximately 30,000 dependent wives of naval personnel per annum

in labor and delivery. The induction of large numbers of women into the Nurse Corps, the WAVES, the Marine Corps, and the SPARS presented gynecological problems never before confronting the Navy. Both of these factors have resulted, in the peacetime of 1946, in a continuance of family dependent services with practice and graduate training facilities in obstetrics-gynecology as a specialty on a high plane of proficiency.

8. Caudal anesthesia has finally arrived to assume its place of importance in the obstetrical armamentarium. Carefully trained personnel, adequate equipment and proper selection of cases seem to be the answers. Its value as an anesthetic for Cesarean section must not be overlooked.

9. The use of follicular hormone combined with progesterone in the treatment of threatened and habitual abortion is a step forward. It has been the experience of many that follicular hormone alone is sufficient in most cases.

10. Heartburn, a particularly annoying episode to so many women during pregnancy, has been treated successfully with prostigmine bromide.

11. Early ambulation in surgery of the pelvis combined with the use of non-absorbable suture materials continues to be offered as a prevention of thrombophlebitis and with excellent results.

12. Rutin has been advanced as important in the treatment of purpura.

13. Genital malignancy has been studied by vaginal smears. This apparently opens a new field of investigation in gynecological cytology.

14. Four cases of air embolism have been reported following the use of a vaginal insufflator during pregnancy.

15. Early ambulation of all degrees, in the puerperium has undergone a rigid test during 1946. Surprisingly, there has not appeared on record the catastrophic results predicted by so many. Time may tell a different story but to date it appears there is little difference in the rate of recovery between the 14-day patients and the early risers.

16. Determination of the period of gestation as 266 rather than 280 days has been the result of the study of basal temperature graphs to determine the time of ovulation.

17. Powdered human milk has been used in infant feeding with great success, particularly in Sweden where collection centers have been established in several parts of the country. The process for preparation is similar to that of preparing powdered cow's milk.

DENTISTRY

1. Dental caries and oxalates.—The role of oxalates in the process of the development of dental caries is being investigated. It has been

found that dietary oxalates are instrumental in dental calculus formation. It has also been observed that neutral solutions of certain citrates will cause etching of dental enamel *in vivo*, and that certain acids, such as oxalic acid, will not cause etching of dental enamel but will protect it against the action of other acids *in vivo*.

2. Dental caries and the dental enamel cuticle.—Studies of the dental enamel cuticle may reveal new information in connection with the mechanism of human dental caries. It has been found that the remnants of the enamel-forming organ persist on teeth in various forms: Cellular, hornified, calcified, and combinations of these. It is probable that these forms may influence dental caries.

3. Dental caries studies and bacteria-free rats.—The use of bacteria-free rats in the study of dental caries may be helpful in more definitely establishing the role of bacteria in the dental-caries process. This is a research method, whereby colonies of bacteria-free animals are fed various sterile diets under sterile conditions for the purpose of determining if bacteria must necessarily be present in dental caries. Individual strains of bacteria may be introduced into the animals in order to determine the effect of each.

4. Dental caries prevention.—Research workers have reported that the development of ammonia nitrogen in the mouth may be responsible for the absence of dental caries, and that amino acids present in human saliva are utilized for its production by the enzyme systems present in the oral cavity. They report that ammonia artificially introduced into the mouth has a limiting effect on aciduric bacteria.

5. Preventive dentistry.—The minimum number of topical applications of sodium fluoride necessary for maximum effectiveness in lowering the incidence of dental caries in children's mouths has been determined. The number of applications per tooth to assure optional protection now appears to be more than 3 and less than 7 of a 1 or 2 percent solution. Conservative reports place the percent reduction in the caries attack rate at 40 to 50 percent.

6. Dental epidemiologic studies.—By applying the science of statistics to large dental epidemiologic studies it has been possible to compile and report important data. It has been shown that the region of birth is significant in the incidence of human dental caries, and that the incidence of dental caries and the amount of dental attention were less in the West South Central and East South Central States, than in the Middle Atlantic and New England States. It has also been shown that the number of dentists in the United States is insufficient and not distributed according to regional needs but according to income per capita of population and that the larger number of dentists in any region when compared to that in other areas, does not result in a relative reduction in the development of dental caries per person. A method

for determining a time dentist factor to treat unit persons, as well as for determining a dental attention index has also been developed.

7. Pure cultures of spirochetes.—A technique for performing agglutination tests with pure cultures of certain oral spirochetes and *Treponema pallidum* has been reported. It is claimed to be the first publication of a method for performing serological tests with certain of the oral spirochetes.

CANCER

1. One of the most significant advances in this field was the use of cancer extract from rat cancer, which, when injected into rats with malignant tumors resulted in recession of the condition. Furthermore, the use of the extract acted to prevent cancer when injected into healthy rats that were later inoculated with cancer cells. This work, done in 1946 at the Wistar Institute, has been on animals only but Russian developments with other tissue extracts, notably those from connective tissue, were used on man with apparent clinical improvement in certain types of cancer.

2. Progress has been made in the serological diagnosis of malignancy. One test depends upon the effects of blood serum upon unicelled protozoa. Inactivated and diluted serum from healthy animals had no effect, while that from cancerous animals had a lethal effect upon the paramecium, the protozoan used by two Russian investigators.

OPHTHALMOLOGY

1. Perhaps the most remarkable development was the observation published by Gregg that congenital cataract occurred in nearly 75 percent of children born to mothers who had German measles during pregnancy. In all cases the cataract followed only if the disease was contracted during the first trimester. Recent studies at the Ophthalmological Laboratory of the University of California indicate that the toxic material in the amniotic fluid is prevented from acting on the lens of the embryo after the first three months by the growth of Descemet's and Bowman's membranes, which then act as a barrier to the toxic agent.

2. The value of certain sulfur preparations in the eye and also given internally in the treatment of burns of the eye, particularly of the cornea, is an important development of 1946. The drug used, sulphydryl, has also been employed with success to promote healing of x-ray burns in other parts of the body.

3. An outstanding achievement in ophthalmic medicine for the past year was the use of diisopropyl fluorophosphate (DFP) in the treatment of glaucoma. Although definite conclusions as to the complete results cannot be given at this time, it should be safe to conclude that

this reagent has certain attributes which seemingly mark it as a definite advancement in the medical treatment of glaucoma.

4. Ophthalmic surgery presented no remarkable advancement during the year 1946. The principles and techniques of corneal transplantation became more firmly entrenched and standardized. The field of cyclodiathermy in the treatment of glaucoma has been narrowed by proof that it is of great benefit only in selected cases of secondary type glaucoma in Negroes. The use of scleral resection in combination with other surgical procedures in the treatment of glaucoma has once again been advocated. Perhaps the most interesting report, however, is that of Cutler who has improved upon an old technique in using the basket type of implant after enucleation. This implant is so constructed as to allow the insertion of the rectus muscle to its edges at operation, thereby theoretically making for better control of the ultimate prosthesis. It is claimed that there will be no more "sinking in" of the upper lid with this device than with the ordinary glass ball implant. This is a definite improvement and should be considered a step forward in the field of ophthalmic surgery.

LARYNGOLOGY

1. During the last few years the general public has been alarmed over the casual relationship of tonsillectomy and poliomyelitis. Cuning and Roberts, in two recent articles, would indicate that statistics do bear out such a casual relationship. Roberts' figures indicate that 274 cases of poliomyelitis have followed recent tonsillectomies in the past 35 years, whereas 70,000,000 tonsillectomies were done during that period. About 52,000,000 were on patients under 18 years of age, and of these, 24,000,000 were done during the poliomyelitis months. If the 274 cases had occurred during the considered poliomyelitis months the incidence would have been 1 case of poliomyelitis to 100,000 recent cases of tonsillectomies, whereas, the average annual incidence 1 poliomyelitis case to 3,250 population.

2. Tuberculous laryngitis has been successfully treated by streptomycin which is now considered the most efficacious therapy in this disease.

3. Clerf and Herbat have studied bronchial secretion cells in an attempt to make an earlier diagnosis of lung sarcoma. The diagnosis has been so made in 90 percent of proven cases. Twenty percent of the cases could not be identified by bronchoscopy alone.

OTOLOGY

1. Fenestration of the labyrinth is now generally accepted in clinical otosclerosis. Lempert now states he obtains permanent restoration of serviceable hearing in 60 percent of his cases. This figure may be

bettered by new techniques. There is considerable evidence that osteogenesis of the fenestra may be inhibited by employing a stopple and using a two-stage operative technique, viz, first inserting an immobile, snug cartilaginous stopple and placing a tympano-meatal flap over the fenestra. There is also some experimental evidence, in animals, that osteogenesis may be inhibited by burnishing the optic capsule and fenestra with a lead bur. This one factor of inhibiting osteogenesis increases the chances of obtaining serviceable hearing.

2. Severe tinnitus may result from an inflammatory process in the tympanic sympathetic plexus as a sequela of middle ear disease. Ten out of 15 cases have been completely relieved by tympanosympathectomy. The plexus is approached by lifting the lower half of the tympanic membrane and then removing the mucous membrane over the promontory which contains the plexus. This operation can be done without disturbing the hearing.

3. Development of a speech reception test and devices for the accurate instrumental measurement of residual hearing.

4. Clear definition of the condition known as aerotitis media, its etiology, and its treatment by dental means and radium.

5. Treatment of the deaf has been greatly aided in the acoustic clinics set up by the Navy for the rehabilitation of these cases. The treatment is based on the careful appraisal of the type and amount of deafness, the psychological and social effects of the loss of hearing, and the selection of the proper treatment to conserve the residual hearing and to enable the person to resume as normal a place in society as possible.

ANESTHESIA

1. This was an important year in the history of anesthesia as it was the centenary of the first public demonstration of the successful use of ether as an anesthetic agent. On October 16, 1846, Dr. William T. G. Morton, a dentist who had previously used ether in tooth extractions (the first time on September 30), administered the anesthetic at Massachusetts General Hospital for Dr. John C. Warren who removed a tumor from the jaw of a patient who slept quietly through the operation. Dr. Warren's remark at the end of the operation, "Gentlemen, this is no humbug," should be remembered among other historic sentences, as it certainly began a new era in surgery.

2. The experimental study of the effect of central anaesthesia on neurotropic viruses is a subject begun in 1946. Another field of similar character is the use of radioactive isotopes to carry the anesthetic to the central nerve system.

3. The introduction of curare as an accessory to anesthesia is perhaps the most striking event in the field, which can be credited almost wholly to the calendar year of 1946.

4. Although a consequence of experience during the war, the results are being fully appraised that chloroform is still a highly important general anesthetic as a noninflammable and nonexplosive agent for surgery under emergency and combat conditions.

PREVENTIVE MEDICINE

1. In 1946 the United States had one of the most extensive epidemics of poliomyelitis in its history. In addition to the large number of cases, it was widespread geographically, all sections of the country being affected. The incidence of the serious bulbar type was also high.

2. Development of a new insect repellent, 448, which if widely used, will affect the incidence of insect-borne disease. The repellent is relatively nontoxic for man, and needs only a small quantity to produce results. The effect persists from 6 to 12 hours.

3. *Epidemiology and communicable disease control.*—(a) Experimentally it was shown that infectious hepatitis spread via water could be controlled by proper chlorination of pretreated and filtered water.

(b) Epidemiology of infectious hepatitis was further elucidated. Use of pooled human serum or plasma for control injections or as a vehicle or diluent for parenteral administration was generally condemned.

(c) Circumstantial evidence pointed quite definitely to a milk supply as the source of infection in an outbreak of infectious hepatitis.

(d) Studies of cases of smallpox among civilians and military personnel revealed that in none was a clear-cut history of a recent satisfactory vaccination demonstrated. In vaccination of thousands of civilian personnel it was demonstrated that about 33 percent were susceptible to the disease. This large percentage of susceptibles points to a potential danger of widespread smallpox.

(e) Experimental inoculations of certain birds with the virus of St. Louis encephalitis served to show that a viremia developed which suggested that birds might readily serve as natural sources of mosquito infection. No fowl showed any sign of illness as a result of the infection. Of 3 species of animals tested none developed a viremia.

(f) It was found that skin-testing material prepared from amniotic membranes of chick embryos infected with mumps virus was antigenic, thus pointing the way to inoculation of military personnel susceptible to mumps.

(g) Experiments with intracutaneous virus immunization offered hope of more efficient vaccination procedures. There is strong evidence that influenza virus vaccine containing the A and B types of

virus is capable of furnishing means of immunization against epidemic influenza. Work on this subject has been done on an extensive scale since 1941 and the results now can be considered extremely promising.

(*h*) Inactivation of viruses and bacteria by physical methods appeared to open up new avenues of prophylaxis.

(*i*) A new method of simultaneous vaccination against smallpox and yellow fever using the skin-scarification method was developed at the Dakar Institute.

(*j*) Study of the problem of prevention of fungous infection of the feet resulted in the consensus that foot-baths were non-effective. Recommended preventive measures were good general sanitation and good foot hygiene, including, when indicated, the use of a good fungistatic foot powder, such as zinc undecylenate.

(*k*) A rapid control method for bubonic plague was developed by combining 10-percent DDT dusting to control the flea population first, followed by the use of sodium monofluoracetate (1080) as the raticide.

(*l*) The use of 5 percent dimethylphthalate emulsion impregnated uniforms in one infantry unit reduced the cases of scrub typhus to a number $\frac{1}{15}$ of that occurring in an unprotected infantry unit using the same area.

(*m*) In oral administration of penicillin it was found that trisodiumcitrate buffered penicillin was the most satisfactory preparation. One hundred thousand units given before each meal and at bedtime gave effective serum levels of 0.04 unit per cc. for 8 to 12 hours. The use of this preparation in mass prophylaxis of streptococcal infections was thought to be dangerous from the view of the possibility of developing penicillin-resistant strains of the organism.

4. *Tuberculosis control*.—(*a*) Case-finding has been vigorously applied during 1946 with particular emphasis placed on the x-ray examination of the chest required of all naval personnel at the time of separation from the service. During the period 1 January–31 August, 2,773,061 x-ray examination were recorded, for the greater part of persons being separated. Of these persons, 4,850 were subsequently admitted to hospitals for clinical study, 3,628 because tuberculosis was suspected, and 1,222 for other reasons suggested by the films. The great value of such case-finding to the individuals concerned, and the tremendous potential savings to the Government, is obvious.

(*b*) Progress in experimentation with active immunization with such agents as BCG and the vole bacillus has attracted the attention of the Navy Department in 1946.

5. *Venereal disease control*.—(*a*) The Navy made great effort during the year to continue cooperation with social, religious, and welfare agencies in their efforts to further a broad social-hygienic program

which supports high moral standards and promotes the prevention of social and venereal diseases. A new agreement between the Army and Navy, setting up joint disciplinary control boards, was signed by both Secretaries. This agreement sets up a senior board in Washington, D. C., with representatives of the War and Navy Departments as members. It also reorganizes the boards in the naval districts and Army commands with a view toward strengthening and implementing these boards.

(b) The syphilis study group is concentrating on the study of crystalline penicillin "G" which does not require refrigeration and appears to be much more effective in the treatment of the venereal diseases. Its cost is little more than the amorphous penicillin. New schedules and preparations of penicillin in peanut oil and beeswax have been used experimentally with promise of success in the treatment of syphilis by 1 or 2 injections per day. Other new forms of penicillin are being developed.

6. *Malaria*.—Research was continued to find better drugs for use in malaria. Present evidence indicates that of those studies chloroquin appears to be the best because of its nontoxicity and its ability to delay onset of relapses in vivax malaria 20 to 30 percent longer than either quinine or atabrin. To date no casual prophylactic has been found.

7. *Insect and pest control*.—(a) Advances in insecticides and repellents together with studies of their uses were many and varied during 1946.

(b) Benzene hexachloride, hexaethyl tetraphosphate, and Velsicol 1068 showed promise as insecticides superior in some respects to DDT. However, DDT maintained first place in importance as an insecticide. An example of advances in its uses is the preliminary dusting of rat burrows and infested areas before using raticides.

(c) Dispersal of DDT by aircraft for control of flies was employed over 2 civilian areas with good immediate kill, but with no demonstrable effect on the incidence of poliomyelitis.

(d) Field tests gave promising results with premixed rodent control baits and nonpoisoned prebaits, canned with inert gas. This method is expected to provide convenience, effectiveness, economy of material, and increased safety in handling.

(e) Spectacular results in fly control resulted from the use of sawdust soaked in slightly sweetened water to which sodium monofluoracetate ($\frac{1}{8}$ ounce per gallon) was added. The mixture was suspended in cheesecloth bags, drained until the cloth surfaces were slightly damp and then hung about in desired locations.

(f) Other potential uses of 1080 were indicated, namely, in the control of red ants, cockroaches, crickets, ground squirrels, and prairie dogs. (1080 must not be used by inexperienced personnel.)

(g) The Bureau of Animal Population at Oxford University has developed a new method for taking the census of rat population. The method is based on food consumption before and after poisoning.

(h) A "Bibliography of Rodent Control" consisting of 3,400 titles was completed by the National Research Council, Rodent Control Sub-Committee.

(i) The U. S. Public Health Service has been experimenting with DDT in alphanaphthylthiourea (ANTU) as a rodenticide which kills ectoparasites in addition to rodents. This organization has reported 60 to 75 percent control of the Norway rat with good mortality to ectoparasites. ANTU kills only the Norway rat, not the black or roof rat. Dogs and cats were not reported killed during the treatment of 31 food establishments, although they were very numerous.

(8) *Sanitation and general hygiene.*—(a) An outbreak of food poisoning due to "Frozen Meals" procured by Naval Air Transport Service led to studies on improved methods of preparation, handling, and testing of this product. Most of the risk arises from possible thawing during shipment or storage.

(b) Experimental work showed that the standard methods of water purification, including coagulation, activated carbon, and filtration, will remove practically all DDT from water.

(c) Emphasis was placed on improving methods of purifying ship-board water supply, to eliminate hazards of operating low pressure evaporators in polluted harbors and of taking on water from sources of doubtful quality ashore.

(d) Improvement in housing design was suggested as the means of reducing the number of people sleeping in one room, thereby lowering the incidence of upper respiratory infections.

(e) Studies in the use of ultraviolet irradiation of living spaces to reduce incidence of streptococcal infections was continued.

DERMATOLOGY AND SYPHILOLOGY

1. The more exact evaluation, establishment of precise dosage schedules and therapeutic assays of different penicillin fractions for antisyphilitic therapy, including the use of the antibiotic in syphilis of the cerebrospinal system.

2. The introduction and employment of BAL in the combatting of arsenical reactions and certain other ill effects from heavy materials.

3. The introduction and evaluation of fatty acid-containing preparations (undecylenic acid, propionic acid) in the prevention and treatment of superficial fungous infections.

4. The compounding and employment of preparations containing new miticides, larvicides, and ovicides in the more effective treatment of scabies, pediculosis, etc. (DDT, benzocaine, benzyl benzoate-containing emulsions).

5. The discovery and employment of new exterminators of insect pests and of insect vectors (DDT, etc.); and the consequent reduction of insect bites and insect-borne diseases (from bed bugs, ticks, fleas, etc.).

6. Improved insect and tick repellents, for use on clothing, objects, and persons; and the ensuing reduction of insect bites and insect-borne diseases.

7. The development of more effective sunscreening and light-protective agents.

8. The development of more effective topical protectives against thermal burns (flash burns).

9. The introduction and standardization of improved local antiseptics and of local antibiotics (tyrothrycin, etc.); and of better local therapy for burns and infected wounds, including chemical measures for the selective and gentle removal of slough and for accelerating healing.

10. Advancement in knowledge concerning skin diseases due to the effects of temperature, humidity, etc.; in particular the mechanisms connected with prickly heat and its possible connection with thermogenic anhidrosis (tropical anidrotic asthenia).

11. The introduction and use of the so-called "antihistaminic agents" in the management of certain cases of allergic skin reactions.

12. The use of high doses of vitamin D (calciferol) (up to 600,000 I. U. daily), in the effective treatment of many cases of hitherto intractable tuberculosis of the skin (severe lupus vulgaris, scrofuloderma, tuberculous adenitis, ulcers, sinuses, etc.).

RADIOLOGY

1. The use of radioactive phosphorus in leukemia and polycythemia, already mentioned as a significant advance in general medicine, is also one of the triumphs of radiology.

2. Improvements in diagnosis of vascular conditions by better visualization of the great vessels and heart have been made.

3. Greatly improved radiological diagnostic methods for anomalies of the base of the heart and the great vessels are another feature of the year.

ANATOMY

Anthropometric studies directed particularly to the measurement of joint movements and the determination of the exact centers of rotation, flexion, and extension and changes in the locus of these move-

ments were one of the advances of the year in anatomy. It is expected that this work will be of value in reparative surgery and the design and fitting of artificial limbs.

PHYSIOLOGY

1. The most important recent development is the recent work of Trueta, Franklin, et al., at Oxford, demonstrating the existence of a neurovascular mechanism by which circulation to the glomeruli of the kidney can be arrested reflexly while the circulation to the medulla continues. In the opinion of a distinguished American authority this is the most important single advance in physiology since the discovery of insulin. The interpretation of renal function tests and the pathology of many kidney conditions must be revised. It also opens the question of similar effects in other organs.

2. Another outstanding advance during the year has been the fractionation of the blood proteins and the purification of the various fractions, particularly thrombin and fibrin.

PATHOLOGY

1. *Coronary atherosclerosis*.—The intima of the coronary arteries lying in the epicardium is thicker than that of any artery of similar caliber elsewhere in the body and is thicker in males than in females. There is marked individual variation. There is evidence that the predilection of atherosclerosis for the epicardial branches of the coronaries is based on the relative thickness of the intima. Diets high in animal fats and deficient cholesterol metabolism hasten coronary atherosclerosis. The familial incidence of coronary disease, undoubtedly related in part to inherited peculiarities of cholesterol metabolism, to dietary habits, or to tendency to hypertension, is to a significant degree related to inherited characteristics of the coronary intima.

2. *Atomic-bomb injuries*.—As an addition to the types of injury due to air blast, water blast, and solid blast caused by the explosion of the atomic bomb a summary of the actual and potential causes and forms of radiation blast injury is given.

Cause	Resultant
1. Thermal (electromagnetic radiation).	1. Burns: (a) Flash, due to infrared and ultraviolet ray. (b) Flame, due to induced fire.
2. Ionizing radiation: (a) Gamma rays and neutrons.	2. Radiation effects: (a) Radiation sickness, blood and lymphoid dyscrasias, skin damage, gonadal damage, induced tumors.
(b) Induced radioactivity in individual and environment.	(b) Blood dyscrasias.
(c) Residual radioactivity from fission products.	(c) Blood dyscrasias, induced tumor.

3. *Radioactive isotopes.*—In addition to the radioactive phosphorus which was found some years ago to be of value in the treatment of the leukemias and polycythemia vera many radioactive isotopes of elements having physiological importance, such as carbon, sulfur, iron, iodine, etc., can now be used as tracers for the study of cellular physiology and pathology. For example, by the use of a radioactive isotope of iodine, radiation can be concentrated not only in a thyroid carcinoma, but will act as a tracer for metastases.

4. *Cellular changes produced by extracts of human organs.*—By the injection of lipoid extracts of organs (liver, spleen, and lymphnodes) of 5 patients with leukemia, 1 with Hodgkin's disease, and of 4 control cases (3 of heart disease and 1 of cerebral tumor) into 28 guinea pigs, it was observed that: (a) Extracts from human myeloid leukemia organs produced "myeloid reactions" or infiltrations in guinea pigs; (b) extracts from lymphoid leukemic organs produced "lymphoid reactions"; (c) extracts from organs involved with Hodgkin's disease produced "Hodgkin's reactions"; and (d) extracts from "normal" organs produced slight lymphoid or monocytoid infiltration. These changes are produced by a keto-acid and a hydroxy-acid which were also found by Turner and Miller in urine and feces of patients with the various diseases of the leukemia group.

THE NOBEL PRIZE IN MEDICINE, CHEMISTRY, AND PHYSICS, AND
SOME OTHER MEDICAL PRIZE AWARDS IN 1946

Medicine-----	Joseph H. Muller, University of Indiana. For his work in genetics.
Chemistry-----	Professor James B. Sumner, Cornell University (one-half the prize). For his work on the crystallization of enzymes. Professor Wendell M. Stanley and Professor John H. Northrop of the Rockefeller Institute for Medical Research at Princeton. For work on the preparation of enzymes and viruses in pure form, they divided the other half of the chemistry prize.
Physics-----	Professor Percy W. Bridgman, Harvard University. For his research on high pressures and physical phenomena attendant on them. (Discoverer of "dry ice.")

Wellcome Prize and Medal..... Major C. J. Wildman (MC) A. U. S.
The Gorgas Medal..... Brigadier General R. A. Kelser, for-
merly Chief of the Veterinary
Division, Surgeon General's Office,
U. S. Army.



EDEMA OF THE CORNEAL EPITHELIUM CAUSED BY ATABRINE

Author's summary.—A summary is presented of the case records of three patients admitted to this hospital complaining of severe blurring of vision in both eyes which developed while each was taking 0.2 gram of atabrine a day. One patient had received a larger therapeutic course of atabrine 21 days previously, the second had received therapeutic courses of the drug repeatedly for almost 2 years up to 2 months previously and the third patient had received 0.2 gram of atabrine a day for 27 days up to 9 days before admission to this hospital. Examinations of these patients' eyes showed edema of the corneal epithelium, "bedewing" of an unusually fine texture and uniform appearance with the slitlamp. Bullae were never seen and staining with fluorescein solution never occurred. Dilatation of the pericorneal vessels or other signs of irritation were never noted. Examination of the eyes otherwise showed no abnormalities. General physical examination of all three disclosed no other significant abnormality. All three soldiers appeared to be in excellent health. There was no dermatitis or other skin eruption. An eosinophilia in one could not be accounted for by repeated stool examinations. In cases I and II minimal corneal changes visible only by slitlamp examination persisted for 3 weeks when 0.1 gram of atabrine a day was taken. These changes finally disappeared 3 weeks after the drug had been discontinued and 0.6 gram of quinine a day substituted. A small therapeutic course of atabrine given to each resulted in a full-blown recurrence in all three. Discontinuance of atabrine a second time in all three, with substitution of 0.6 gram of quinine per day in two, again resulted in a disappearance of the corneal epithelial edema.

Note from author's conclusions * * * "This process is apparently reversible and does not result in any permanent damage to the ocular tissues."—REESE, F. M.: Edema of the corneal epithelium caused by atabrine; observation on three patients. Bull. Johns Hopkins Hosp. 78: 325-332, June 1946.

CLINICAL NOTES



FATAL BULLOUS DERMATITIS WITH MULTIPLE LESIONS OF THE MUCOUS MEMBRANES

THERAPEUTIC FAILURE OF SULFADIAZINE AND PENICILLIN

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The simultaneous occurrence in a patient of bullous lesions of the skin and erosions of the mucous membranes presents a challenging diagnostic problem to the clinician. For although this combination has been described in such well-known diseases as pemphigus, erythema multiforme, and toxic drug eruptions, it has also been reported under various other titles. Ectodermosis erosiva pluriorificialis (1), dermatostomatitis (2), and eruptive fever with stomatitis and ophthalmia (3), all with these similar lesions, have been described as distinct entities. Occasionally the diagnosis of foot and mouth disease (4) has to be considered.

The case of a young Allied merchant mariner who died about a month after the onset of cutaneous lesions that progressed to bullae and were associated with a purulent conjunctivitis, rhinitis, stomatitis, tracheobronchitis, orchitis, and urethritis is here reported. Adequate therapeutic doses of sulfadiazine and penicillin did not seem to alter appreciably the course of the patient's illness. The case well illustrates the diagnostic difficulties besetting such lesions for the patient was thought at various periods in his illness to have a toxic drug eruption, severe erythema multiforme, and finally pemphigus vulgaris acutus.

CASE REPORT

The patient was a 28-year-old male Negro from British Guiana who developed multiple "itchy bumps" over his thighs and lower extremities while aboard a ship in the Caribbean area. Within a few days he noticed some dysuria, an urethral discharge, and his left testicle was painful. Shortly thereafter the skin lesions "filled with water" and extended over his trunk and extremities. Because he had had sexual intercourse 2 weeks prior to his urethral discharge the captain of the ship gave him, upon the advice of a port physician, 8 tablets of sulfadiazine a day for 6 consecutive days. The painful testicle enlarged, the patient became prostrate, and the skin lesions increased in size and number. In the

belief that his illness was a venereal disease he was isolated for 2 weeks with diet restricted and but little treatment. About the tenth day of his confinement the patient felt feverish for the first time. He was discharged from his ship and later entered a naval dispensary for treatment.

Upon entry to a naval dispensary the patient was drowsy, listless, dehydrated, and appeared quite ill. His temperature was 104.8° F., pulse 100, and respirations



FIGURE 1.—Appearance on the second hospital day showing vesicles and bullae.

20 per minute. Blood pressure was 110 systolic and 64 diastolic (millimeters of mercury). Over the face (fig. 1) there were many small vesicles. The neck and trunk showed numerous larger vesicles and many small flaccid bullae. The extremities showed a few vesicles but only rare bullae. Fluid from the bullae was gray-white, serous. Over the extensor surfaces of the extremities were localized, small, indurated areas more deeply pigmented than the surrounding Negro skin. A few of these areas were also seen on the flexor surfaces and on the trunk. Both eyes showed a marked purulent conjunctivitis. The vermillion borders of the lips showed erosions with some bleeding. The mucous membranes of the tongue, and the buccal and palatal areas were coated with a thick gray-white exudate except in some areas where there was erosion of the membranes,



FIGURE 2.—Appearance on the sixth hospital day showing the marked epidermolysis.

The nose showed erosions of the mucous membranes and a sero-purulent discharge. Coarse rhonchi were heard in both lung fields. The heart, lungs, abdomen, extremities, and neurological examination were negative except for the cutaneous lesions. There was slight erosion of the skin of the prepuce, and the left testicle was enlarged to about three times the size of the right.

Laboratory examinations showed a slight hypochromic anemia, a leukocyte count varying from 3,500 to 8,500 per cubic millimeter, and a normal differential count. Kahn serological test was negative. No sulfonamide was present in the blood. Non-protein nitrogen was 30 mg. per 100 cc. Urine revealed no bile, sugar, or acetone, a 2 plus albumin, 3 to 10 leukocytes, and 0 to 4 erythrocytes per high-power field in unconcentrated sediment. Blood smears for malarial parasites, blood cultures, and culture of the fluid from the lesions were all negative. The urethral discharge was examined for bacteria by smear and blood agar culture under increased carbon dioxide tension. Both examinations were negative. Culture of the sputum showed the usual respiratory tract flora. Roentgenogram of the chest showed "Considerable increase in peribronchial markings without evidence of infiltration." A few days later a second examination showed: "Increase in the peribronchial markings." Examination of the cerebrospinal fluid showed a normal cell count, and negative Pandy and Kahn tests.

Throughout the course of the disease the temperature was remittent and varied between 102° and 104° F. The pulse showed a gradual ascent from an original level of 100 to a level between 120 and 140 per minute. The patient remained surprisingly lucid throughout although he was obviously losing weight and becoming weaker. Most of the vesicles progressed to bullae, these ruptured, and the skin peeled off and left pink-white areas of denudation markedly con-

trasting with the uninvolved dark areas (fig. 2). The stomatitis became severe with necrosis of large areas of mucous membranes. Salivation was copious. There was considerable expectoration and the patient complained frequently of sore throat and dysphagia. A linear ulceration of one cornea appeared and the conjunctivitis became more marked. The patient vomited frequently and had almost constant singultus throughout his hospital stay. A cough productive of purulent material was present. There was ulceration of the prepuce, a slight urethral discharge persisted, and the patient complained of dysuria. Erosion of the mucous membranes of the nose, lips, and mouth progressed with the skin erosions. These latter areas of denudation finally covered an estimated 50 percent of body surface. No skin lesion showed any evidence of healing. The patient died on the ninth hospital day, about 1 month after the onset of his cutaneous symptoms. Unfortunately, necropsy was not permitted.

Symptomatic treatment of his skin and mucous membranes was carried out during his period of hospitalization. Boric acid ointment and pressure dressings were used on the extensively denuded areas. Transfusions of citrated whole blood, plasma, and saline-dextrose infusions were given. Whole vitamin complexes, thiamine hydrochloride, and ascorbic acid were added to the diet. Penicillin was administered in 20,000 Oxford units intramuscularly every 3 hours for 4 days, a total of 640,000 units. This drug exerted no obvious effect upon the temperature, pulse, symptoms, lesions, or upon the course of the disease.

DIFFERENTIAL DIAGNOSIS

Drug eruptions.—With the widespread use of sulfonamide therapy there appeared 2 reports of bullous skin eruption with associated involvement of the mucous membranes following the use of sulfadiazine (5) (6). One case ended fatally (5). Both cases resembled the symptom-complex first described as ectodermosis erosiva pluriorificialis (1). The case reported here had received sulfadiazine and the lesions were first considered to be a toxic dermatitis from the drug. The patient insisted, however, that his initial lesions appeared days before he received any sulfonamide. Also suggestive was the slow spread of the lesions in contrast to the explosive spreading seen in sulfadiazine eruptions. Other drugs known to give rise to bullous lesions of the skin are inorganic arsenic, iodine, chloral hydrate, phenolphthalein, antipyrine, bromides, and barbiturates. Recently, penicillin (7) has been added to the list. Even severe involvement of the mucous membranes as well as the skin may occur in phenolphthalein, antipyrine, and phenobarbital toxicity (8). The patient had received none of these prior to his illness. Whether the sulfadiazine or penicillin given him aggravated his illness cannot be determined.

Erythema multiforme.—Severe forms of erythema multiforme (8) may start with malaise, fever as high as 105° F., and are soon followed by a skin eruption. This is initially macular and papular and later becomes vesicular and bullous. The bullae may become extensive and late in the disease new ones may arise on normal skin. Sites of predilection are the dorsa of the hands and feet first, the oral regions

second, and the genitalia third. Lesions of the mucous membranes are almost always present and frequently become secondarily infected. Purulent conjunctivitis may lead to blindness (9). Most cases occur in children and young adults. Although the usual type of erythema multiforme is recurrent, severe forms rarely have preceding attacks and any subsequent ones are milder. Alarming symptoms may be present at the onset of the disease but only 4 fatal cases have been recorded in the literature. This diagnosis was seriously considered in the patient in the case report because of his age and the presence of indurated, pigmented areas on the extremities which suggested that originally these lesions might have been erythematous. However, the large areas of skin denudation and the positive Nikolsky sign all over the body were more characteristic of pemphigus. The extensive epidermolysis of the trunk and lesser involvement of the extremities favored the latter. Also of importance was the course of the disease with its gradual onset of the cutaneous lesions, the development of a high fever late in the disease, and the subsequent fatality. For these reasons it is believed the case reported was one of pemphigus vulgaris acutus.

Miscellaneous.—Ectodermosis erosiva pluriorificialis (1), dermatostomatitis (2), and the eruptive fever with stomatitis and ophthalmia of Stevens and Johnson (3) were originally described as entities because of the lack of recurrence, high fever, and the severe mucosal lesions. For the belief was prevalent at those periods that such extensive lesions were not found in erythema multiforme. However, many authors have since pointed out transition forms from a mild erythema multiforme to the cases having mucosal lesions similar to those seen in these diseases. Klauder and Lever, among others, regard these diseases as severe forms of erythema multiforme (4) (8).

Cases of septic (acute or butcher's) pemphigus are said to be not a true disease entity but either a bullous eruption occurring in the course of sepsis, erythema multiforme, or pemphigus vulgaris acutus (8). Foot and mouth disease may show mucosal lesions as well as cutaneous but the latter are limited to the skin near the mucocutaneous junctions and to the fingers and toes (4). Dermatitis herpetiformis is a rare disease with symmetrically distributed groups of lesions that may contain bullae. Usually there is a combination of papules, small vesicles, and pustules arising from an erythematous base with considerable itching of the lesions.

PEMPHIGUS

Since the writings of Kaposi (10), who reported the first large group of cases in 1896, pemphigus has been a well-known disease clinically. Its etiology is entirely unknown although various bacteria and a virus

have been suggested as the causative agent. It has usually been divided into 3 types, namely, pemphigus vulgaris, pemphigus vegetans, and pemphigus foliaceus, but 2 additional types have been described—pemphigus erythematosus and pemphigus conjunctivae. The most common is pemphigus vulgaris and it is characterized by the outbreak upon apparently normal skin or mucous membranes of successive crops of bullae (fig. 1). These break and leave areas of erosion upon the involved tissues (fig. 2). In some areas there may be no bullae and the upper layers of the epidermis slide, or are easily rubbed off (Nikolsky's sign). Erosion of the lips, the mucous membranes of the mouth, the pharynx, and occasionally the larynx, may occur. Denuded areas frequently become secondarily infected. Constitutional symptoms are present, and the course is usually a progressive one. Kaposi estimated that about 25 percent of the ward cases he had seen had died in the hospital and that probably 30 to 40 percent more may have died after leaving it. Over a period of 26 years Wile (11) saw 80 patients with the disease and said that all died within a few months. It has been emphasized (12) that pemphigus vulgaris is divided into two types—an acute, malignant, and a chronic, more benign form.

In the 114 cases of pemphigus reported by Lever (12) 33 were diagnosed as *pemphigus vulgaris acutus* and of these 31 (94 percent) died. The average age at onset of symptoms was 52 years, and the average duration of the disease in those who died was 7 months. Two-thirds of the patients were Jewish. The bullae were flaccid and broke easily. Oral lesions were present in 28 of the 33 cases (85 percent) and were the first discernible in 18. In the 18 cases where the disease started in the mouth there was an average interval of 2.9 months between the appearance of the oral and the subsequent cutaneous lesions, but oral involvement was not of prognostic aid. The pharynx and larynx were involved in 12 cases. The patient whose case is reported in this paper is an example of the acute type of pemphigus vulgaris but is younger than the average, had a shorter course than usual, and had some macular lesions that are not usually present. This case is probably similar to those cases of pemphigus that are said to have started as erythema multiforme.

Thirty-five of Lever's 114 cases were diagnosed as *pemphigus vulgaris chronicus*, a slightly higher incidence than the acute form, all patients were gentiles, and the mortality was 37 percent. Oral lesions occurred in about one-half the cases, were not as extensive as in the acute form, and did not extend to the vermillion border of the lips. Occasionally the pharynx and larynx were involved. The skin lesions were tense bullae that left erosions tending to heal although the disease persisted for years in some cases. Most of the changes are confined to the upper derma.

LABORATORY STUDIES

The most significant findings other than those usually accompanying sepsis and toxemia are those of the blood serum electrolytes. In pemphigus vulgaris acutus, pemphigus vulgaris chronicus, and pemphigus vegetans, Lever and Talbott (13) found a decrease in the serum sodium, chloride, calcium, and protein levels. These were usually proportional to the severity of the disease and to the amount of skin involved. These findings were regarded as secondary effects of the disease and not causal.

TREATMENT

The list of drugs used is a large one and almost all are of no avail in pemphigus vulgaris acutus. Local application of carbolized calamine lotion and antipruritic powders are advised for the itching. Continuous bath, potassium permanganate solutions, and boric acid ointment have been used in lesions with extensive denudation.

As a result of their serum electrolytic studies, Lever and Talbott have used adrenocortical hormone to raise the lowered blood sodium levels, and dihydrotachysterol, or vitamin D, to raise the blood serum calcium levels. Under this symptomatic treatment they report that encouraging results were obtained. Three of 7 patients with pemphigus vulgaris acutus survived under this treatment whereas, previously, 22 consecutive patients with this type died. In pemphigus vulgaris chronicus the mortality was reduced. In pemphigus vegetans, some complete remissions were obtained in all 3 patients treated but the mortality was not significantly changed. In the other forms of pemphigus no striking response was noted.

SUMMARY

A case of fatal bullous dermatitis associated with ophthalmia, rhinitis, stomatitis, tracheobronchitis, orchitis, and urethritis is reported. This is probably a case of pemphigus vulgaris acutus, though somewhat atypical. A brief discussion of the differential diagnosis, treatment, and features of the disease is presented. It is of note that neither sulfadiazine nor penicillin affected the short course of a month's duration from the onset of symptoms to death.

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PERICARDITIS DURING PENICILLIN TREATMENT FOR SYPHILIS

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Reactions are frequent following the penicillin treatment of syphilis according to preliminary reports (1) (2) (3) (4). These reports indicate that penicillin has not been extensively used in the treatment of cardiovascular syphilis. A report of a case of pericardial effusion complicating a case of early syphilis treated with penicillin is presented and the problems raised by the clinical course are discussed.

CASE REPORT

A 19-year-old Negro cook was admitted 29 September 1945, complaining of soreness in his chest anteriorly, with cough and fever. He had noticed discomfort

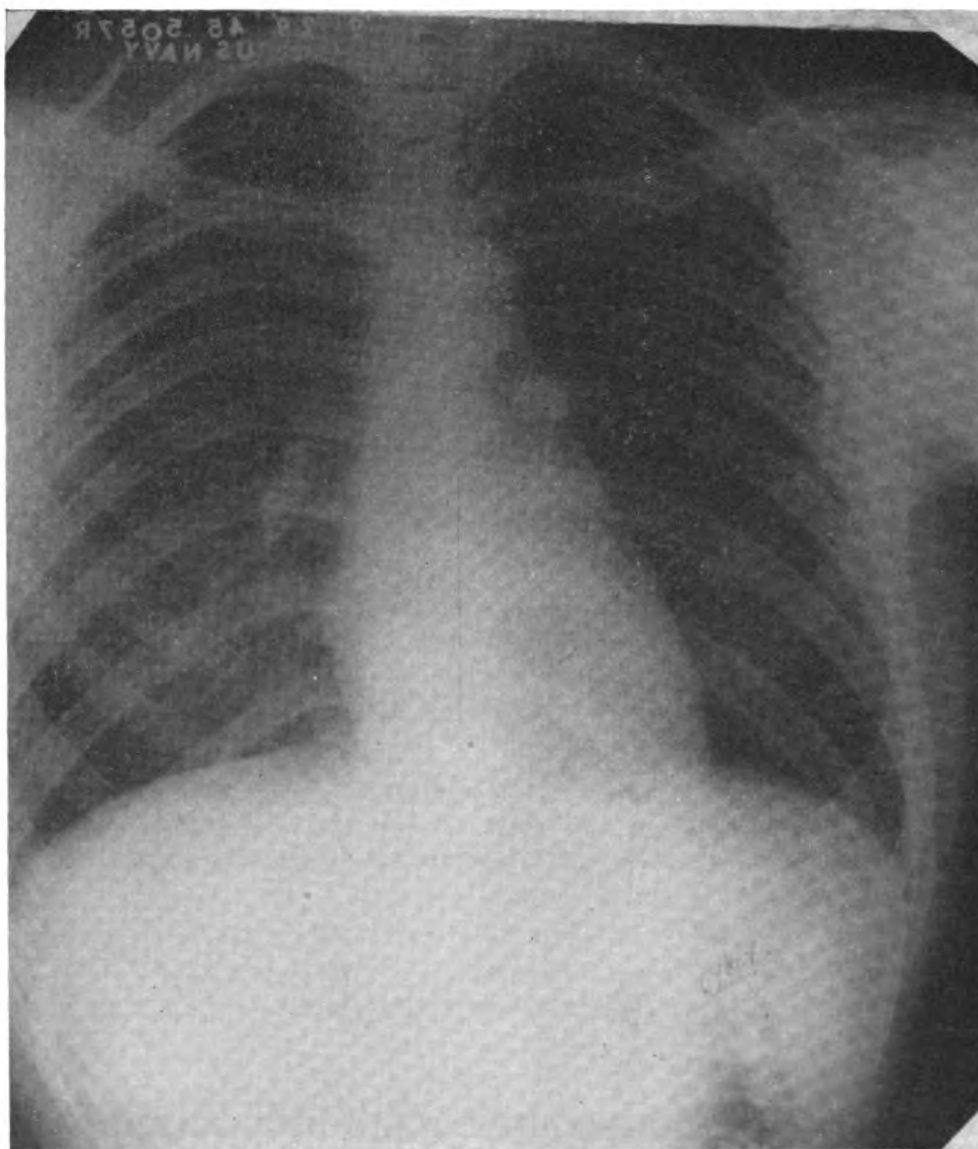


FIGURE 1.—X-ray of chest 29 September 1945.

in his chest for the previous week. An unproductive cough with fever had apparently developed the day before admission. He had spent most of his life in North Carolina on a farm, and parents and siblings were all in good health. His previous health had been good and he denied having had a serious illness, injury, or operation. While in the Navy in 1944 he had an uncomplicated gonococcus infection of the urethra treated with sulfathiazole. At this time it was noted that he had a systolic murmur at the pulmonic area.

Physical examination showed a tall, subacutely ill, moderately husky Negro. Temperature by mouth was 102° F., pulse 110 per minute and respirations 20 per minute. The skin was hot and dry, and no rash was seen. The upper respiratory tract showed no abnormality. Examination of the chest revealed clear lung fields on percussion and auscultation and heart within normal limits. These findings were confirmed by roentgenogram of the chest (fig. 1). The

blood pressure was 118/82. The abdomen was not remarkable. A painless, superficial ulceration was noted on the penis on the right border of the prepuce. This had the appearance of a healing chancre, but repeated darkfield examinations for several days were negative for *Treponema pallidum*. The lymph nodes in the right groin were enlarged and tender. A Frei test was questionable and a Ducrey test was negative. The blood Kahn the day after admission was 4 plus. He continued to complain of pain in the anterior chest and mouth temperature spiked from 100° F. to 103° F. The pulse was regular and the rate varied from 90 to 110 per minute. Examination of the chest failed to reveal

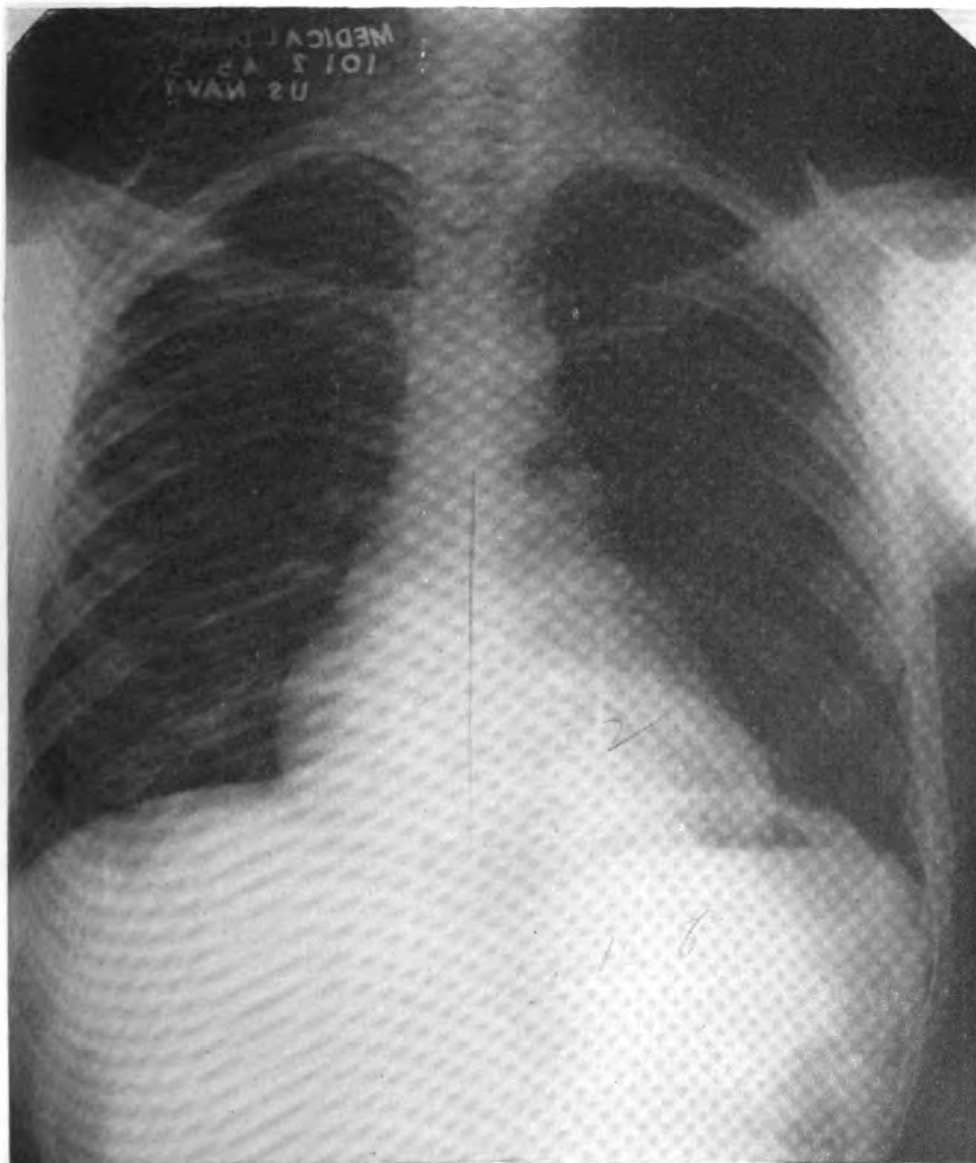


FIGURE 2.—X-ray of chest 12 October 1945.

a pleural or pericardial friction rub or other abnormality, and the pulmonic systolic murmur was not noted at this time.

On the fourth day after admission penicillin therapy for what was considered an early syphilis was commenced. Forty thousand units (4 cc.) were given

every 3 hours day and night. Sulfathiazole, 1 gram, and soda bicarbonate, 1 gram, were given every 4 hours. The spiking fever and tachycardia continued for 3 days. The general condition of the patient seemed excellent. The chest pain diminished, the inguinal adenopathy receded and the chancre healed satisfactorily. Fever subsided by lysis, during the 8-day period of penicillin therapy (2,400,000 units) and the sulfathiazole was discontinued 14 days after the completion of the penicillin. A total of 128 grams of sulfathiazole was administered. The Frei and Ducrey tests were repeated and were negative. Repeated blood Kahn tests showed a persisting 4 plus reaction.

Although repeated examination had revealed no abnormalities intrinsic in the chest a roentgenogram of the chest made on 12 October 1945 (fig. 2) showed the heart enlarged in all its diameters. The cardiac enlargement was more than 25 percent above the average expected for the patient's age, height, and weight according to standard insurance tables. There were no complaints of orthopnea or dyspnea. Examination revealed an increase in cardiac dullness to the right and left but no friction rub could be heard. The pulse rate was 80 per minute and the blood pressure was 122/84. The heart tones were distinct and normal except for a soft, blowing systolic murmur over the pulmonic area which was not transmitted. There was no clinical evidence of cardiac decompensation. The sedimentation rate was 12 mm. in 1 hour, the leukocytes were 11,500 with normal differential, and the erythrocytes were 4,800,000. The heterophile agglutination (Paul test) was negative. Electrocardiographic changes (fig. 3) were consistent with a pericardial effusion. Low voltage, inverted T 1 and T 2 and isoelectric T 3 suggested myocardial damage in addition to pericarditis but clinically this was considered unlikely.

X-ray of the chest on 17 October 1945 (fig. 4) showed by comparison with the previous film 5 days before a decrease in size of the heart shadow. Serial chest x-rays (figs. 6 and 7) showed a gradual return to normal size and shape in 4 weeks, which coincided with reversion of the electrocardiogram (figs. 5 to 8) to normal. The clinical course from this time on was uneventful. The patient had no complaints and was gradually allowed to increase his activity. No evidence of cardiac pathology was evident clinically after the absorption of the pericardial effusion. The low-pitched, blowing systolic murmur in the pulmonic area per-

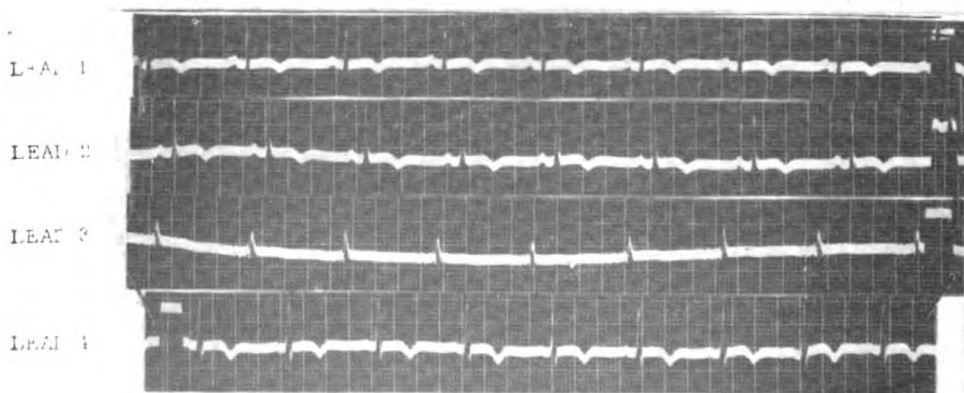


FIGURE 3.—Electrocardiogram 16 October 1945.

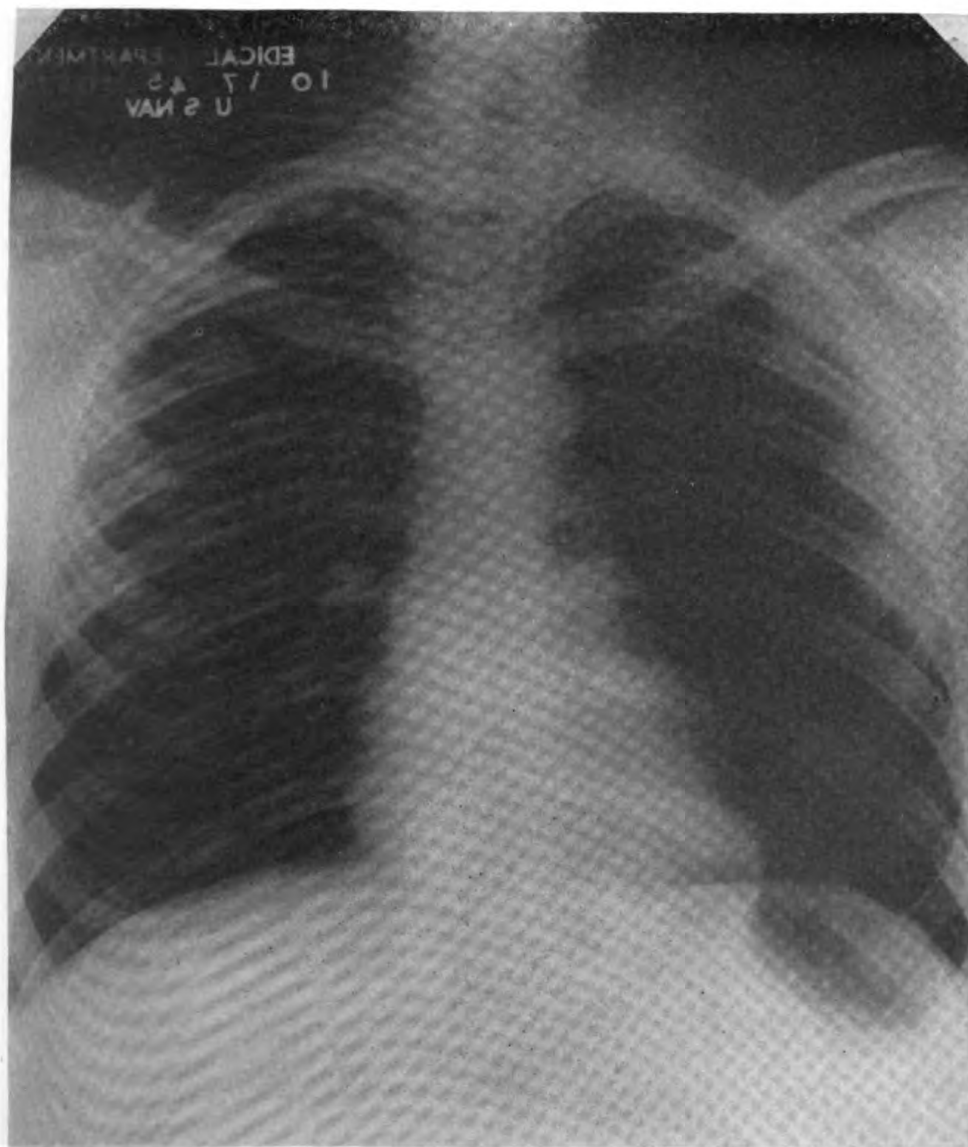


FIGURE 4.—X-ray of chest 17 October 1945.

sisted and was considered to be of long duration, functional in character, and unrelated to the present illness. There was no evidence of a decrease in cardiac reserve. The Schneider index 2 months after onset of the acute illness was plus 9. A tuberculin test (purified protein derivative) was positive with the first strength test dose. The basal metabolic rate was minus 9. The icterus index was 5.3. Between 28 November and 4 December the Kahn changed from 4 plus to doubtful and on 18 December the Kahn, Mazzini, and Wassermann were all reported negative. Spinal fluid examination on 18 December showed no increase in globulin, 31 mg. per 100 cc. of protein, normal mastic, and a negative Kahn. He was discharged to duty on 29 December, 3 months after admission, with instructions to return in 1 month for further serological and clinical studies.

DISCUSSION

The etiology of the pericardial effusion in this case was not determined. Aspiration did not seem warranted at any stage of the disease. The effusion occurred during the course of an acute febrile illness. It is not likely the fever of such a degree could have been caused by the syphilitic infection, although Stokes (5) states that fever is part of the clinical picture in 10 percent of all cases of primary syphilis. Fever when present is usually low grade in character, seldom exceeding 100° F. Prostration, cachexia, and roseola were not present to suggest the "syphilitic typhoid" described by Fournier (5), but there was intermittent fever, spiking to 103° F. and lasting for 14 days despite treatment with large doses of penicillin and sulfathiazole.

An interesting speculation might be made that the high fever and pericardial effusion represented a reaction to treatment with penicillin and sulfathiazole. Stokes et al. (4) have reported frequent

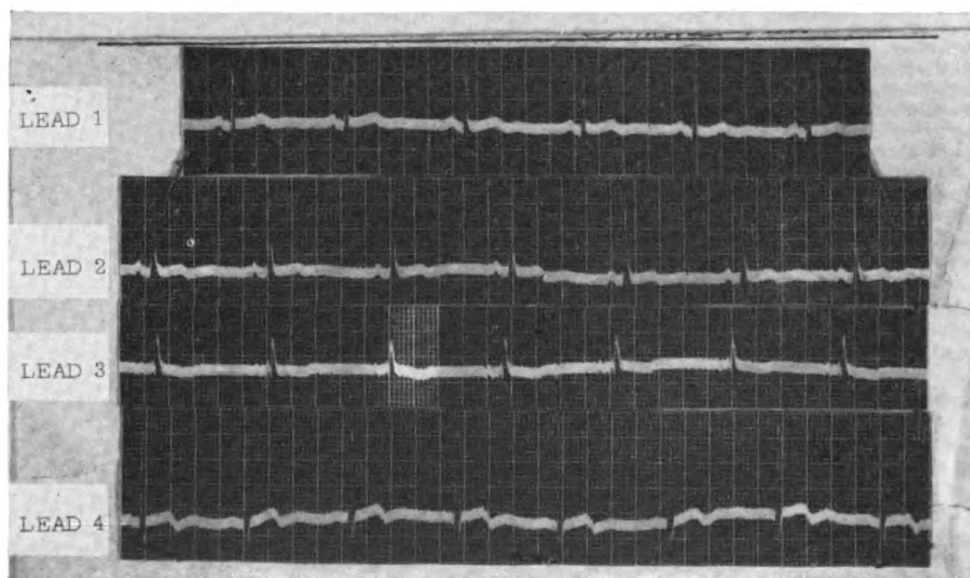


FIGURE 5.—Electrocardiogram 30 October 1945.

reactions to penicillin, most of them mild, in the treatment of syphilis. Of 182 cases treated, 43 (24 percent) had reactions interpretable as Herxheimer or therapeutic shock effects. Of these, 23 were fever, the highest 105.5° F. Cardiac involvement during the secondary period of syphilis has been described by Harlow Brooks (6). Although the darkfield examination of the healing chancre in this case was persistently negative, there was a satellite bubo. The history did not suggest a "monorecitive" or relapse from a previous infection, and it can be fairly assumed that the case was one of primary syphilis with the chancre in the spontaneous healing stage when discovered.

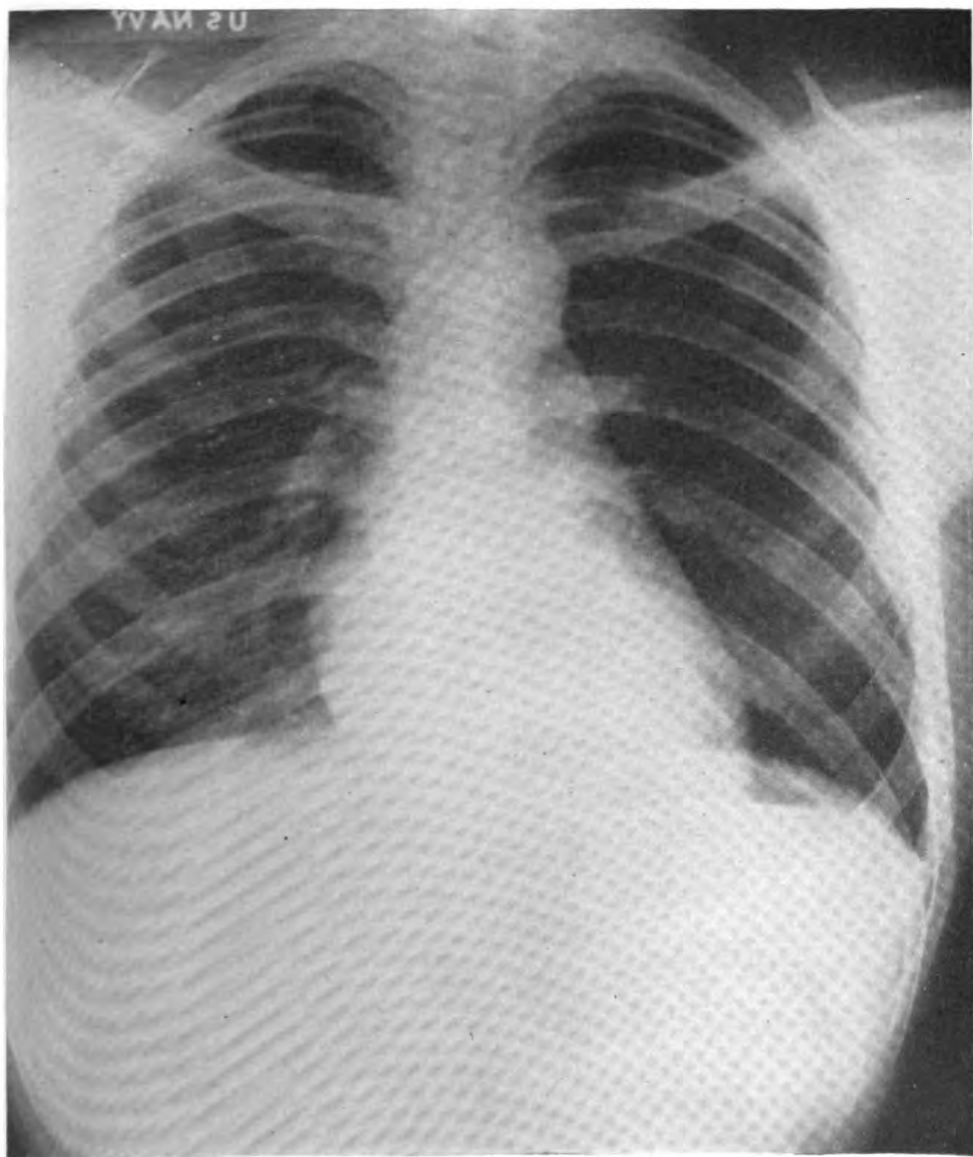


FIGURE 6.—X-ray of chest 25 October 1945.

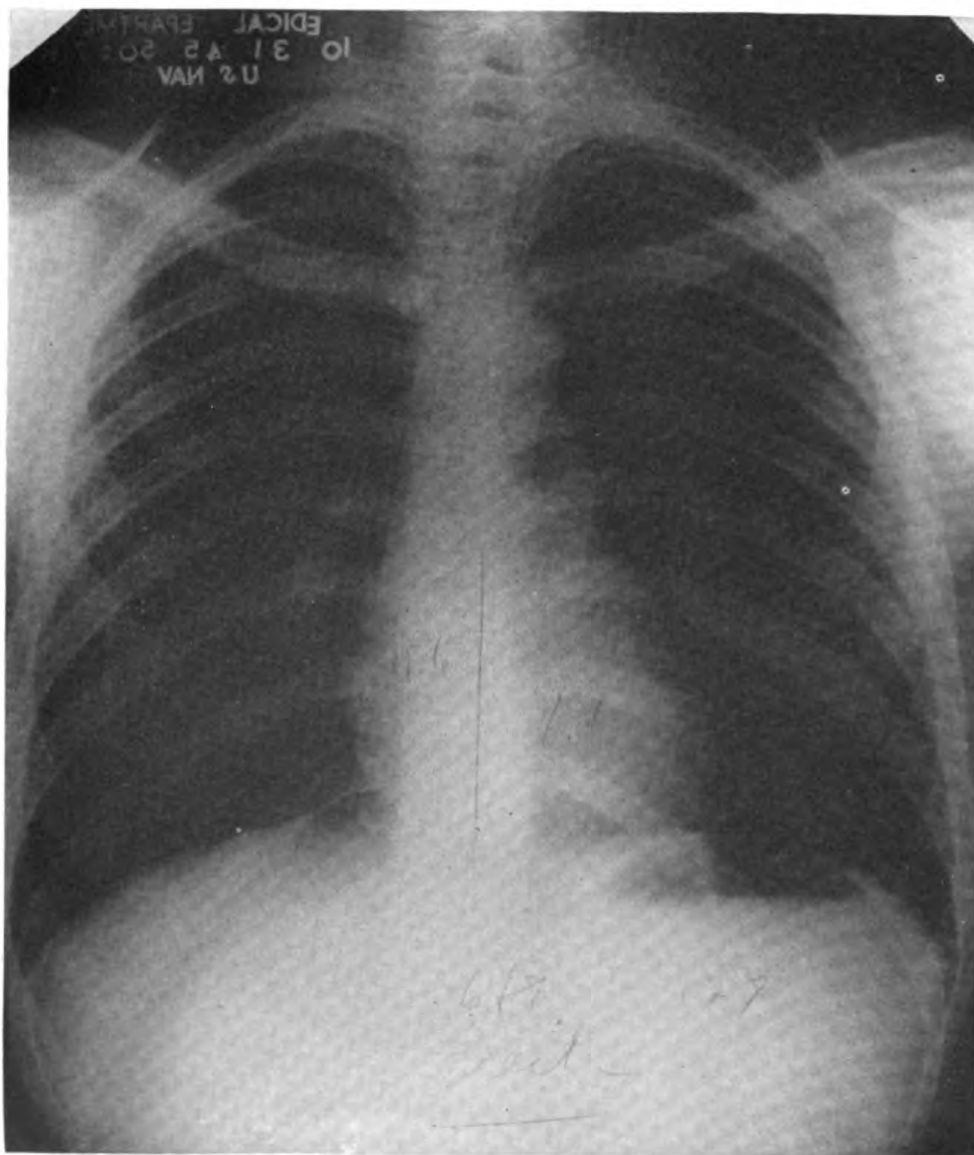


FIGURE 7.—X-ray of chest 31 October 1945.

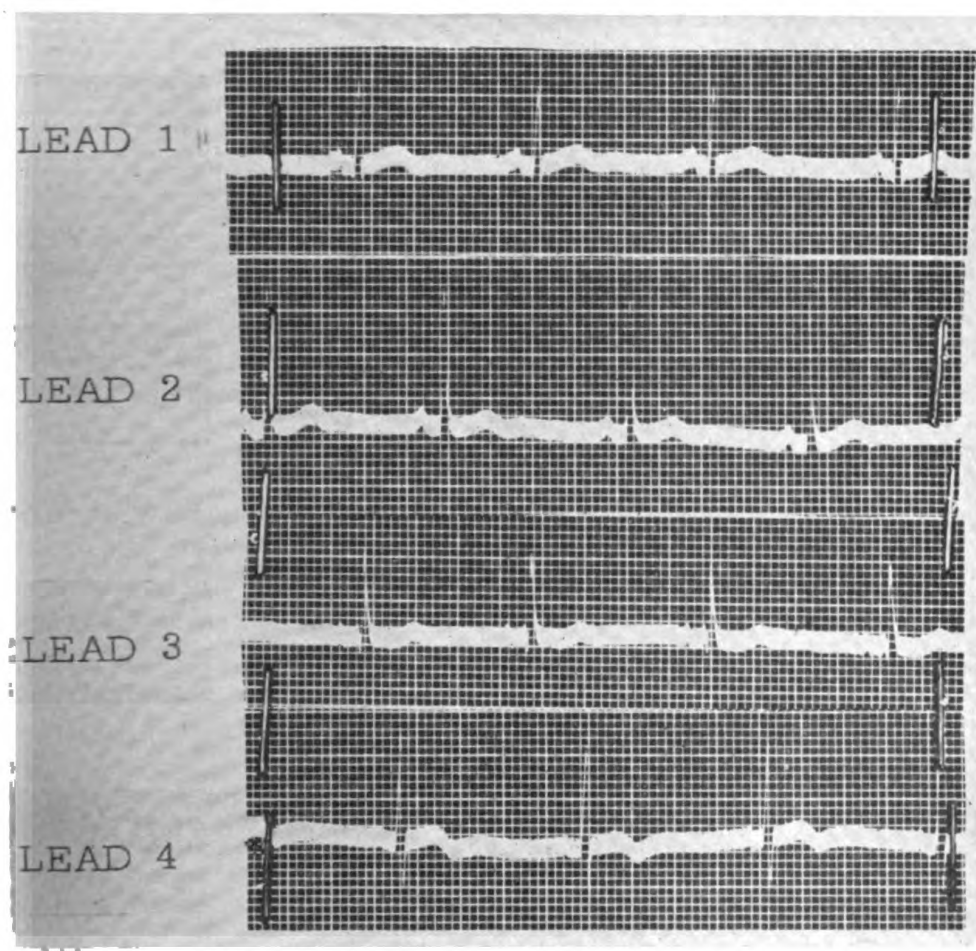


FIGURE 8.—Electrocardiogram 12 October 1945.

It is concluded, therefore, that the pericardial effusion was unrelated to the syphilis, and was due to an acute infectious process caused by an undetermined agent. The clinical course, the lack of toxicity, and absence of marked leukocytosis suggests a virus as the infectious agent.

SUMMARY

A case of early syphilis complicated by a pericardial effusion and marked fever with satisfactory clinical and serological cure with penicillin and sulfathiazole therapy is reported. A relationship between the pericarditis and fever and the infection with *T. pallidum* is discussed and the relationship, in conclusion, considered unlikely. The possibility of hydropericardium as a manifestation of a Herxheimer reaction in the penicillin treatment of syphilis is suggested.

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TREATMENT OF ERYSIPELOID OF ROSENBAACH WITH
PENICILLIN

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Erysipeloid is an erysipelas-like eruption usually appearing on some part of the hand. In acute septicemic cases arthritis and endocarditis often occur. It is associated usually with symptoms of itching and burning and appears as a smooth, circumscribed, more or less edematous plaque, at times as a bluish wheal with elevated circular border somewhat similar to the lesion of erythema multiforme. The plaque slowly extends up the fingers to the dorsal surface. In some cases the infection may be transferred by contact with the hands to other parts of the body, such as the face, nares, external ear, and the feet.

The process is not limited to the skin alone but involves the deeper tissues, including the tendon sheaths and joint capsule. The joints are tender on pressure, especially on lateral pressure.

In a few cases low-grade fever and malaise are also present. The disease is often mistaken for cellulitis with lymphangitis of streptococcus origin, or for erysipelas.

Klauder (2) reported on about 1,000 cases occurring along the northern New Jersey coast. The incubation period was about 1 day and the onset of the lesion was associated with severe, deep-seated pain accompanied by throbbing. Lymphangitis and lymphadenitis were common. In his series, fever, malaise, and headache were almost always present during the first 24 hours. Although the eruption usually heals spontaneously in from 2 to 4 weeks, recurrences and periodically occurring joint pains are frequent. A few cases are very stubborn to any treatment.

ETIOLOGY

The disease is caused by the bacillus of swine erysipelas (*Erysipelothrix rhusiopathiae*; *Ery. erysipelatos suis*) a gram-positive bacillus best identified in cultures of tissue removed from the lesion. The mode of entrance is usually from microscopic or macroscopic abrasions from fishbones, scraping knives, or meat bones. The disease occurs in individuals who handle infected swine, infected fish or crabs, or their products. In the United States most of the reported cases have occurred in fishermen or fish handlers, but it is also very common in meat handlers. In the U. S. Navy most cases have occurred in meat handlers.

THERAPY

Klauder (1) introduced the use of specific antiserum in therapy, reporting encouraging results. Recently sulfa drugs have been reported to be beneficial by Kulchar and Rosenberg (3). However, Klauder (5) claimed that in his experience no striking results were obtained with sulfonamides.

Solid carbon dioxide was used in 15 cases by Griswold and Bowen (4) successfully. In their series the average duration of infection was 44.3 days.

Heilman and Herrell (6) studied the treatment of experimental infections of mice with penicillin and the effect of penicillin on the organisms *in vitro*. The organisms were sensitive to the action of penicillin *in vitro*. Of 40 mice inoculated with the organism and not treated, all died. Of 40 mice inoculated with a similar dose of *Ery. rhusiopathiae* organisms and treated with penicillin the mortality was only 5 percent. Both mice which died received penicillin for only 4 days and treatment was started only 21 hours after inoculation. Of a batch in which treatment was begun 16 hours after inoculation and continued for 7 days, none died. They predicted that penicillin should prove effective in treatment of the disease in man.



—Official U. S. Navy Photo.

FIGURE 1.



—Official U. S. Navy Photo.

FIGURE 3.



—Official U. S. Navy Photo.

FIGURE 2.—Appearance of finger 5 days following injury by a pork bone; and after 4 days of sulfadiazine therapy. In addition there was some lymphangitis of wrist and forearm which had disappeared.



—Official U. S. Navy Photo.

FIGURE 4.—Appearance of finger 3 days later after receiving 640,000 units of penicillin.

A case of erysipeloid recently treated with penicillin with encouraging results is reported.

CASE REPORT

The patient, a 43-year-old male and butcher at a naval hospital, was admitted 27 July 1945. He scraped the right middle finger on a pork bone and the following day the injured area became very sore. He was treated for 4 days with sulfadiazine with only temporary relief. The swelling and erythema of the finger increased and he was hospitalized.

On admission examination was negative except for a dull erythematous and edematous area surrounding the proximal joint of the right third finger. The motion of the joint was limited and there was moderate tenderness over this area. His temperature was 98.6° F.

Treatment was started with penicillin 40,000 units every 3 hours. He received a total of 16 injections, totaling 640,000 units in 48 hours. At the end of that time the edema and erythema had completely disappeared and there was no local tenderness. He was returned to work and has remained symptom-free.

SUMMARY

1. A case of erysipeloid of Rosenbach is reported which was cured dramatically with penicillin.
2. The results justify a widespread trial of penicillin treatment in erysipeloid in order to completely evaluate its use in this disease.

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INTENSIVE AUTOHEMOTHERAPY IN THE TREATMENT OF ACNE

A PRELIMINARY REPORT

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Acne, in its many forms and manifestations, has been an exceedingly common condition throughout the service. It has usually been persistent, and difficult to treat. Upon arriving in North China, it was found that a cooler climate did not, in itself, benefit the majority of cases. On the contrary, many new cases were arising among the men and it was, therefore, decided to treat these cases by autohemotherapy. For the treatment of various skin diseases autohemotherapy has been used often in the past and it was attempted to test the potentialities of this method by an intensive and thorough course of treatment.

The subjects for treatment were 10 Marines, chosen at random from those reporting to the sick bay for treatment. The duration of the disease varied in the individual cases from a few weeks to 8 years. Two cases had previously received a course of penicillin therapy with no permanent benefit being noted. The forms of acne present included pustular, papular, and cystic lesions among the various subjects. No local applications were permitted during the course of treatment; the only local treatment advised was careful soap and water cleansing of the skin several times daily.

The method adopted was the usual method of autohemotherapy, consisting of withdrawing blood from a cubital vein, and immediately reinjecting it into the buttock. The planned course consisted of 2 injections a week for a total of 10 injections. The first injection was a test dose of 5 cc. of whole blood, and all subsequent doses were 10 cc.

Results of treatment of acne by autohemotherapy

Result	After 5 injections	After 10 injections
Cured ¹	0	2
Markedly improved ²	1	4
Improved ³	2	4
Same ⁴	6	0
Worse ⁵	1	0
Totals	10	10

¹ All lesions healing and no new lesions present.

² Majority of lesions healing and no new lesions at time of last injection.

³ Many old lesions clearing and fewer new lesions present than before.

⁴ No change noted.

⁵ Condition worse than before treatment.

The results obtained are tabulated in the table. A marked difference will be noted in the results after 5 injections, and after 10 injections. This probably indicates that the intensity of the treatment is an important factor in the results obtained.

As indicating the results that are obtainable, the three most satisfactory cases are cited in more detail.

CASE REPORTS

Case 1.—A sergeant in the Marine Corps who has had acne for 3 years. He had pustular lesions on his neck, abdomen, back, buttocks, and thighs. He had a previous course of penicillin therapy several months before, but at the onset of the present treatment regime, his condition was still active. There was much scarring present from previously healed lesions, and there were many new papules and pustules present. He showed no undue reaction to the treatments. At the end of 5 treatments, no new lesions were appearing. Improvement was steady and uninterrupted up to the end of the therapy, at which time all his old lesions were receding, and no new lesions were present.

Case 2.—A warrant officer in the Marine Corps who had acne for a period of 12 months. He had papules on the back and buttocks. After the second and fourth injections he developed a shaking chill that lasted for 10 minutes. After 5 injections, all lesions on his back had receded. Those lesions present on his buttocks were healing, and no new lesions were present.

Case 3.—A private, first class, in the Marine Corps who had had acne for 8 years. He had papular lesions of the face and back. On each cheek were several large cystic lesions. He showed no undue reaction to the treatments, and at the end of 5 injections, only very slight improvement was noted. By the time the tenth injection was reached, all the cystic lesions of the face had receded, all lesions on his back were healing, and all that remained were 3 small crops of papules on the face.

From the results obtained in this limited series of cases, it cannot be suggested that the above method generally be adopted for the treatment of acne. However, the results indicate that further investigation of this method, or some modification of it, may yield a useful adjunct in the management of these cases. The conclusion can be drawn that autohemotherapy, when continued over a long period of time, does have a beneficial effect upon the condition. Possibly a more intensive treatment regime will further increase the effectiveness of this form of treatment, but that will also have to be investigated before a definite statement can be made.



A CASE OF GRANULOMA PYOGENICUM TREATED SUCCESSFULLY WITH PENICILLIN

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Granuloma pyogenicum is a small, pedunculated, vegetation of exuberant granulation tissue varying from 0.1 to 2.0 cm. in size. It bleeds on slight provocation, and is most likely to develop on locations exposed to trauma. The tumor develops rapidly and persists for months unchanged. If incompletely excised, it quickly recurs. Pure cultures of *Staphylococcus pyogenes* have been repeatedly cultured from these lesions. Satisfactory treatment in the past has been excision under local anesthetic followed by cautery or any adequate destructive sterilizing procedure.

In view of the probable pyogenic etiology of this disease and the known response of staphylococcus infections to penicillin, there is every reason to believe that granuloma pyogenicum will respond to penicillin therapy. The following case is suggestive but further studies are necessary.

CASE REPORT

The patient, a 26-year old white male, was first seen on 19 March 1945, when he complained of a small bleeding tumor on the ulnar side of the distal phalanx of his left fifth finger. This tumor had started following an infection of that finger in February. Examination of the lesion revealed a pedunculated, inflamed, angiomatoid, bleeding granuloma 0.5 cm. in diameter, on the ulnar side of the distal phalanx of the left fifth finger.

On 26 March, it was coagulated by electro-cautery of a diathermy and he was followed for a week during which time the wound had almost completely healed. During the latter part of May he again returned to the sick bay with a recurrence of the granuloma plus a cellulitis of the distal phalanx. The infection was treated with hot boric-acid compresses but ambulatory treatment was unsatisfactory.

He was admitted to the sick bay on 29 May at which time his temperature was 99.4° F., pulse 80, and respirations 20. Physical examination at that time was essentially negative except for a cellulitis of the left fifth finger extending from the distal to the proximal phalanx and a pedunculated, bleeding granuloma on the ulnar side of the distal phalanx. Routine laboratory examinations were essentially normal. An x-ray of the finger on 1 June revealed normal bone development.

He was treated with penicillin, 20,000 units intramuscularly every 3 hours for a total of 400,000 units. Locally, the lesion was treated with hot compresses for 1 hour four times a day followed by a penicillin mold dressing. The penicillin mold dressings were continued for a total of 8 days.

The swelling and inflammation of the cellulitis receded rapidly and he was discharged on 8 June, at which time the granuloma was much less inflamed and had begun to decrease in size. Without further therapy, the granuloma con-

tinued to shrink and 2 weeks after discharge only a slightly elevated, violaceous nodule was present. Two months after treatment only a small scar remained where the granuloma had existed.

SUMMARY

A case of granuloma pyogenicum treated with penicillin intramuscularly and penicillin mold compresses locally responded rapidly to treatment is reported.

Further investigation is needed to determine whether penicillin mold compresses locally will be sufficient treatment or whether systemic penicillin therapy alone will be adequate, or whether both forms of penicillin therapy are necessary.



LYMPHOGRANULOMA VENEREUM

REPORT OF A CASE TREATED WITH PENICILLIN AND SULFADIAZINE

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and

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The treatment of lymphogranuloma venereum may be described as expectant, medical, and surgical. A large percentage of cases subside spontaneously, and without further treatment than bed rest. Medical treatment with antimony compounds and with sulfonamides may be of value in some patients, but these may often be insufficient to cure or to arrest the progress of the disease, and surgical intervention, namely incision and drainage of the affected lymphnodes and of perianal abscesses may be required.

For medical officers with but one assistant, or pharmacist's mates on independent duty aboard smaller vessels, surgical procedures and after care must often be held at a minimum. The following case report is offered as a suggestion in the treatment of cases of lymphogranuloma venereum aboard smaller naval vessels.

REPORT OF CASE

A steward's mate, first class, U. S. C. G. R., 22 years old, colored, reported to the sick bay on 3 January 1946, presenting a small ulcer near the frenulum of the penis. He gave a history of intermittent sexual exposures, with and without protection and prophylaxis, from 1 December to 18 December, and on 31 Decem-

ber 1945, in Recife, Brazil, during the ship's in-port period. Physical examination revealed a small triangular shaped ulcer, not painful or tender, which had a grayish-non-purulent base, and smooth edges, near the frenulum of the penis. A darkfield examination revealed no *Treponema* forms, a smear showed no evidence of Ducrey's bacillus, nor was there any satellite inguinal lymphadenopathy. The temperature was normal. Unfortunately, there was no Frei antigen available for a Frei test. A diagnosis of abrasion of the penis was made, and the ulcer was dressed with sulfadiazine powder and a dry sterile dressing. A Kahn test on 9 January was negative. Dressings were changed as required, but healing was slow.

On 12 January, the ship being at sea, the patient returned to the sick bay complaining of a small tender "kernel" in the left inguinal area. There was a slight elevation of temperature, but there were no other signs or presenting symptoms. The "kernel" itself was found to be a small hard lymphnode. He was told to report back in 2 days for observation. On 14 January he returned, presenting a painful, tender mass, approximately 6 cm. by 3 cm. in the left inguinal area, in which numerous tender lymphnodes, adherent to the subcutaneous tissues, were palpable, and with edema in the subcutaneous tissues.

The temperature was 100° F., pulse 90 per minute, and respirations 24 per minute. The patient complained of feverishness and malaise, in addition to his presenting symptoms. A diagnosis of lymphogranuloma venereum was made and the patient was immediately put to bed. Expectant treatment had failed, and it was decided to try penicillin and sulfadiazine. Since penicillin is effective against the same organisms as sulfadiazine, it was felt that the synergism of the two drugs would effect a speedier recovery. Accordingly, a dosage immediately and every 2 hours thereafter of 50,000 units of penicillin intramuscularly, and sulfadiazine (with an equal weight of sodium bicarbonate) grams 4 immediately and grams 1 every 4 hours thereafter, day and night, was ordered.

Within 24 hours the temperature returned to normal, the mass became less edematous and painful, and the patient mentioned that he was far more comfortable than before entry. Diagnostic aspiration of pus of one lymphnode was then made. A little pus was obtained, and a Wright's stain smear showed bluish inclusion bodies, which however, did not resemble Donovan's bodies, in the cytoplasm of the pus cells. The patient's temperature rose to 100.5° F. within 4 hours after the aspiration, and for this reason, no further diagnostic tests were made. With the continuance of treatment, the temperature returned to 98.6° F., and varied between 98° F. to a discharge temperature of 98.6° F. The mass gradually grew smaller in size and less tender, the patient complaining less each day of pain and tenderness in the area of the mass. On the fourth day, the dosages of all medication were halved for each interval, and on 19 January, the mass had disappeared. The patient was discharged, to return to full duty. He had received 2,075,000 units of penicillin intramuscularly and 24 grams of sulfadiazine (and sodium bicarbonate) orally. He was off duty for a few hours less than 5 days.

DISCUSSION

Since surgery would have had to wait, in any event, till the mass had become ready for incision and drainage, medical treatment was indicated. Treatment with antimony compounds is sometimes attended by undesirable reactions and, therefore, another means of treatment, based on the synergism of penicillin and sulfadiazine, was used. The method of treatment adopted did not, in our opinion, keep the patient off duty longer than would have incision, drainage

and after-care of the infected lymphnodes and the incision wound; and it halted the progress of the disease without the hazard of post-operative infection. It was felt that even had surgical intervention been necessary, it would have had to be followed up by chemotherapy or biologic therapy. By initiating the latter immediately upon diagnosis, farther progress of the disease was checked, healing could take place, postoperative complications were avoided, and the loss of time off duty was held to a minimum.

From the experience afore-mentioned, it would also seem worthy of attempting thereapeusis of more advanced cases with penicillin and sulfadiazine, either to obviate the need for, or as an adjunct to, surgery.

CONCLUSIONS

1. An early case of lymphogranuloma venereum, treated with penicillin and sulfadiazine, is presented.
2. The treatment outlined is believed especially useful for medical officers serving with but one assistant, or for pharmacist's mates on independent duty aboard smaller naval vessels.
3. The treatment outlined is believed to obviate, or at least to reduce, the need for surgical intervention in early cases, and to make minimal the time lost by the patient off duty.
4. Similar treatment of more advanced cases would appear to be worthy of trial.

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TINEA CAPITIS

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Fungous diseases in the Tropics are abundant in occurrence, resistant to treatment, and responsible for a considerable amount of disability. The compromising effects of the Tropics, the extreme heat, over-

crowded quarters, and poor personal hygiene all add to the difficulty of the problem. These factors are most common among the native population and it is in these people that disease is particularly prevalent. The treatment and cure of disease in natives are of considerable importance, because of the possibility of infection of our military personnel stationed in the Tropics.

Ringworm of the scalp is a fungous infection and occurs principally in school children. It is caused generally by the microsporon, occasionally by the endothrix, and rarely by the ectothrix. The clinical picture shows one or more circular patches of erythema, crusts, or follicular pustules. The lesions may be extremely suppurative and boggy, forming raised inflammatory swellings of small abscesses. These lesions are called kerion.

The following case is being reported as it shows the characteristic picture of a fungous infection of the scalp. It also shows what can be accomplished therapeutically by persistence with fungicidal agents when x-ray is not available.

CASE REPORT

A 12-year-old native Chamorro was admitted to the civilian hospital on 1 January 1945 with a history of having had a lesion on the bridge of his nose for about 2 weeks. With this, he had also developed scattered lesions on his scalp.

Examination showed a circumscribed, dry, scaly lesion on the forehead just above the nose. On his scalp were several circular, erythematous, crusty, pustular patches about the size of a 5-cent piece. Over the occiput there was a large, purulent, round lesion the size of a silver dollar. This lesion was raised, boggy, and showed numerous small pustules from which pus could be expressed (fig. 1). The posterior and anterior cervical nodes were enlarged and tender.

On admission to this hospital his temperature was 100° F. and he continued to run a fever up to 101° F. which gradually subsided to normal at the end of 2 weeks. A blood count showed 58 percent hemoglobin and 3,330,000 red blood cells. There were 11,000 white blood cells with 5 percent eosinophilia. The Kahn and urine examinations were negative. The stool was positive for ova of hookworm, *Trichuris trichiura*, and *Strongyloides stercoralis*.

A specimen of hair was removed from the lesion on the scalp and microscopic examination showed the presence of a fungus. Cultures were then made which showed a growth of *Ectotrichophyton mentagrophytes* (*Trichophyton gypseum*).

On admission to the hospital wet dressings of potassium permanganate 1:4,000 were applied to the scalp. He was given 1 gram of sulfathiazole every 4 hours for 6 doses, then 0.5 gram every 4 hours for 6 days to control the secondary infection. The temperature subsided, but the lesions showed very little change. Three thousand Oxford units of penicillin were given intramuscularly every 3 hours for a total of 100,000 units with some clearing up of the infection. He was started on a saturated solution of potassium iodide, 5 drops in water 3 times a day, and wet dressings of potassium permanganate 1:4,000 were again applied. In addition to this the lesions on his scalp were painted daily with tincture of iodine and all the hairs in the affected area gradually epilated. The lesions began to show gradual improvement. The swelling subsided and the affected areas looked cleaner. This plan of treatment was continued for 3 weeks and then dressings

of 5 percent salicylic acid and 10 percent sulfur ointment were applied. For general treatment he was given a transfusion of 500 cc. whole blood, ferrous sulfate, and Japanese vitamins. Three cc. of tetrachlorethylene was given for the intestinal parasites. There was a steady improvement in his condition and on discharge after 10 weeks the scalp just showed only several clean bald spots.

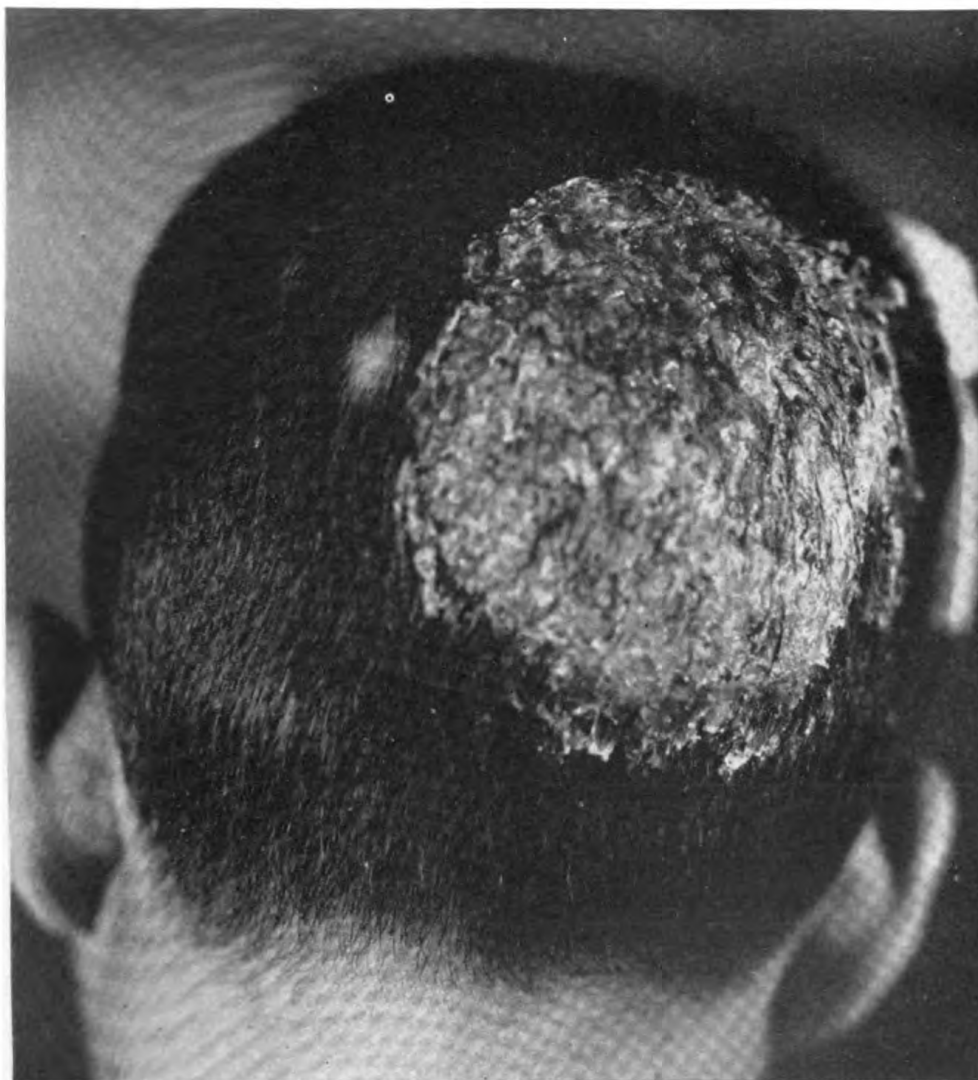


FIGURE 1.

The differential diagnosis in this case was difficult and the final diagnosis was not established until the culture was reported. Favus was considered but the lesions did not show the sulfur yellow, dry, cup-shaped scutula which are so characteristic of this disease. A staphylococci dermatitis or pyoderma had to be differentiated, but this diagnosis was discarded since the lesions remained localized, did not itch and failed to respond to antiseptic measures. Blas-

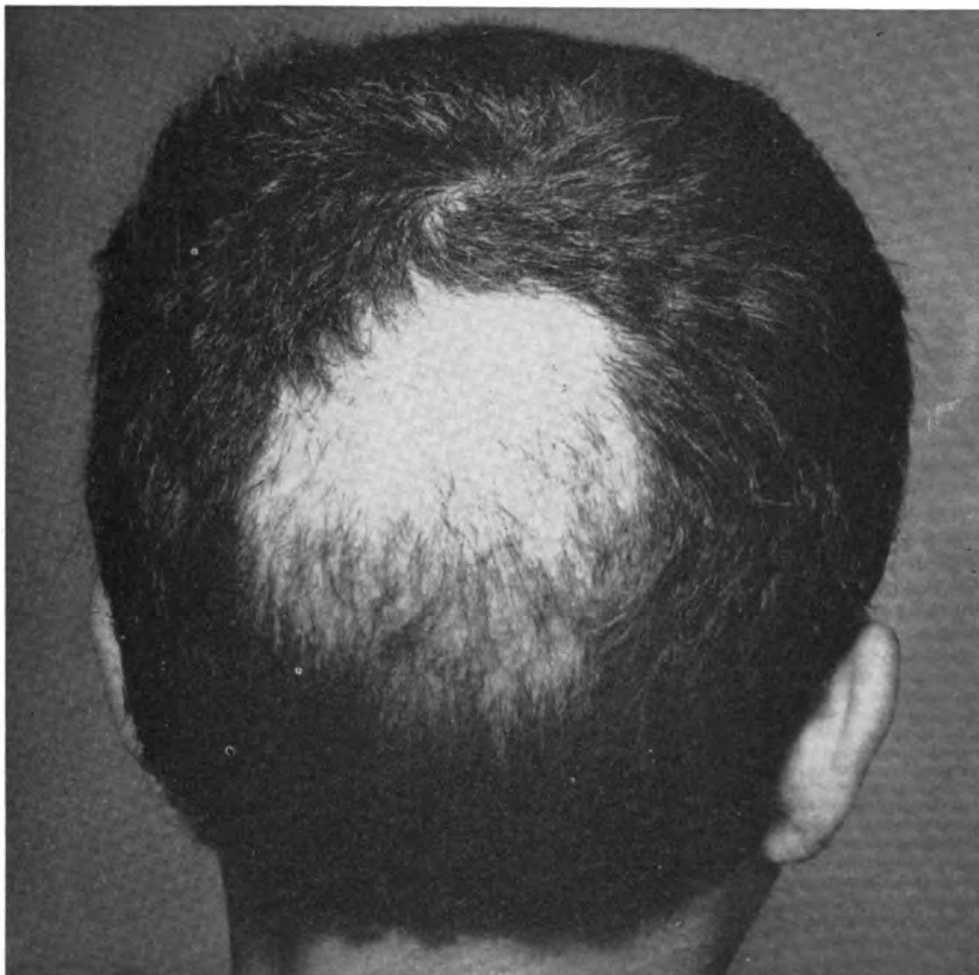


FIGURE 2.

tomyocosis was also considered as a possibility, as the lesions were granulomatous and pustular and over the areas involved there were some thick crusts oozing a purulent exudate.

Forty-two days after discharge, he was seen again and at this time there was a new growth of hair at the sites of the lesions (fig. 2).

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FULMINATING HEMOLYTIC STAPHYLOCOCCUS AUREUS INFECTIONS

RECOVERY FOLLOWING PENICILLIN THERAPY

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Penicillin therapy has remarkably altered the course and grave prognosis of fulminating hemolytic *Staphylococcus aureus* infections. Prior to the use of penicillin, Skinner and Keefer (14) reported a mortality rate of 82 percent in a series of 122 cases treated by various methods including sulfas; since then, in striking contrast, the mortality rate dropped to 13 percent in a series of 31 cases collected from current literature. Clinically, the toxemia of the infection is usually indistinguishable from a septicemia. Following penicillin therapy, recoveries are so frequently dramatic that fewer blood cultures will be found to be positive, the only accepted basis for the diagnosis of septicemia. Consequently, a clinical syndrome of systemic infection, irrespective of the results of blood cultures, should be immediately and intensively treated.

Our purpose in making this report is to emphasize (1) the fulminating character of the toxemia resulting from hemolytic *S. aureus* infection, (2) the importance of the clinical findings in making the diagnosis irrespective of laboratory evidence of a septicemia, (3) the immediate administration of large doses of penicillin, and (4) the resulting remarkable clinical course of the disease with recovery. These points are illustrated in the case report following.

CASE REPORT

The patient, aged 18 years, was admitted to the sick bay with recurrent furuncles and carbuncles during the past 6 months. He complained of a swollen, mildly painful infection of the right elbow of 4 days' duration. Physical examination was negative except for a pea-sized furuncle on the elbow. Temperature was 99° F.; no lymphangitis or palpable glands were present.

Following warm boric acid dressings for 24 hours, a peculiar vesiculation of the superficial skin was cautiously denuded with sterile forceps without trauma, pressure, or manipulation (fig. 1). That night the patient awakened with chilly sensations. At 7:00 a. m. his temperature was 102.4° F. and he had slight choreiform movements of the neck and back. The local lesion was unchanged; no suppuration or fluctuation was present. Axillary lymph glands were slightly enlarged and tender. Two hours later the choreiform seizures were clonic, involved the upper extremities, and were accompanied by well-sustained ankle clonus. Sodium pentobarbital did not control the seizures. At 11:00 a. m. rectal temperature was 107° F., and intramuscular injections of 50,000-unit

doses of penicillin in 2 cc. physiologic salt solution every 2 hours were started. At 11:15 a. m. rectal temperature was 109° F., the patient was comatose, pulse was 160 and there was mild cyanosis of lips and fingertips. Oxygen was administered intermittently, and the extremities and body were covered with an ice-packed sheet. At 1:45 p. m. temperature was 107° F. rectally, and external stimuli produced slight response. He complained of complete blindness and was only slightly oriented as to voice and sound. There was no eye pathology and the fundi were normal. At 3:00 p. m. rectal temperature was 105° F., and vomiting of bile-stained material occurred.

Complete neurological examination was negative; no neck rigidity was present. Spinal puncture was performed for diagnostic purposes; fluid and pressure were



FIGURE 1.—Denuded vesicle on right elbow which was portal of entry for fulminating hemolytic *S. aureus* infection. Within a few hours after onset of systemic symptoms patient had rectal temperature of 109° F. and was desperately ill. Dramatic recovery followed intramuscular injections of 50,000 units of penicillin in 2-cc. physiologic salt solution every 2 hours for four doses and then 20,000 units every 3 hours for four doses. Total amount of penicillin given was 280,000 units in 24 hours.

normal. Adequate intravenous dextrose and saline solution was administered and at 4:30 p. m. rectal temperature dropped to 102.6° F., when the penicillin was reduced to 20,000 units every 3 hours for 4 doses and then stopped. Lucidity became progressively greater. The following morning temperature was 99.4° F., and his general condition was excellent. He was well oriented except for loss of memory for events during the height of illness. Neurological examination again was negative except for lateral nystagmus of both eyes. The local lesion was unchanged and warm 25 percent magnesium sulfate solution dressings were started.

The laboratory reports were as follows: Blood cultures repeatedly showed no growth. Cultures from furuncle revealed hemolytic *S. aureus* which was coagulase positive. Blood counts were repeatedly within normal limits; white blood count varied from 10,000 to 8,000. Urine was normal. Spinal fluid examination showed normal cell count, less than 20 mg. percent protein, no increase in globulin, and negative smears. Cultures also were negative.

Starting the fifth day, when sitting up in bed, the patient developed recurrent headaches, but these gradually and completely disappeared within 20 days. Transitory jerking movements of the rectus abdominis muscles occurred daily, but these attacks disappeared within 30 minutes either spontaneously without treatment or following intravenous 10 percent calcium gluconate, sodium pentobarbital, intravenous 50 percent dextrose, or a placebo. Gradually over a period of 3 weeks the choreiform movements entirely disappeared. There were no permanent residual symptoms but local recurrences of furuncles showed cultures of the original organism.

COMMENT

The fulminating toxemia, accompanied by extreme elevation of temperature to 109° F. rectally, responded miraculously to 50,000-unit doses of penicillin every 2 hours for 4 doses. The trauma in opening the vesicle was probably the factor precipitating the systemic infection, although every effort was made to avoid trauma during the procedure. The absence of positive blood cultures and leucocytosis is not unusual, especially with severe infections of such short duration. Subsequently, each recurrence of skin infection was found to be caused by the same coagulase positive staphylococcus organism, but there was no recurrence of the systemic syndrome.

Neurologic symptoms, although transient, persisted for 5 weeks with gradual and complete recovery. The effect of the extreme elevation of temperature on the brain centers or biochemical balances, and the possibility of metastatic central nervous system involvement, were considered as possible causes for the recurrent transient choreiform movements. Hypoglycemia or hyperinsulinism, hypocalcemia and hysterical factors were ruled out. No definite explanation for the neurologic symptoms is possible.

DISCUSSION

Foci of infection.—Skin infections are so common in the Tropics, especially among members of the armed forces, that the serious nature of an occasional virulent infection is seldom considered. Many hundreds of such infections are routinely treated without untoward complications. During the period our patient was hospitalized 73 additional cases of skin infections were treated in the dispensary, 12 of whom were admitted to the sick bay for multiple furuncles, carbuncles, or cellulitis. Cultures of these cases revealed nonhemolytic staphylococcus, either albus or aureus; no complications occurred and prompt recoveries followed treatment. Surgical trauma is an important contributing factor for systemic spread of local infection, and even opening or denuding an innocent appearing vesicle can precipitate a fulminating infection. Still, to obtain smears or cultures for determining the causative organism requires opening of the vesicle with the involved danger.

Toxemia with or without demonstrable bacteremia.—The presence of a bacteremia as evidenced by positive blood cultures does not usually alter the clinical picture of systemic infection. Positive blood cultures are seldom consistently found throughout the course of the disease and numerous cultures may still fail to reveal a fleeting bacteremia. The bacteriostatic action of therapeutic agents, such as penicillin, and rapid clinical recovery will reduce the frequency of positive blood cultures. The clinical evidence of a severe toxemia—with or without proved bacteremia—is sufficient to warrant diagnosis of systemic infection and appropriate treatment.

Bacteriology.—Hemolytic *S. aureus* is the most pathogenic of the *staphylococci* (16); the two main varieties are *S. aureus A*, which ferments mannite, and *S. aureus B*, which does not ferment mannite (3). The *S. aureus A*, usually coagulase positive, is the more virulent of the two types and is the organism cultured from the recurrent skin lesions of our patient. Blood cultures made during the acute illness and the recovery period showed no growth, the gravity of the systemic reaction being due to a toxemia with an undemonstrable bacteremia.

From the recent literature 31 cases of septicemia were reviewed, 30 of which had reports of blood cultures (1) (2) (4) (6) (7) (8) (10) (12) (13). *S. aureus* was found in 24 cases, hemolytic streptococcus in 1 case, and 6 cases did not have positive blood cultures (4) (6). Only 6 of the 24 positive *S. aureus* cultures were hemolytic, similar to our case, but no mention of hemolysis was made in the other reports. The fact that 6 cases failed to show positive blood cultures is significant because of our experience with negative blood cultures.

Symptoms.—The primary lesion may appear innocuous. Slight trauma or even the procedure of opening the lesion for obtaining smears and culture material may cause systemic spread of the infection. This is manifested by chills, headache, prostration, nausea or vomiting, convulsive type of seizures, rapid pulse, and elevation of temperature. Chills were reported in 25 percent of the 122 cases reviewed by Keefer. Skinner and Keefer reported that a "larger number of patients with high remittent fevers died than did those with other types of fever." The maximum temperatures ranged from 103° F. to 106° F., while in our case it reached 109° F. rectally, which indicated the desperateness of our patient's illness.

In the series of 122 cases (14) the average duration of the infection was 33 days; 100 percent fatalities occurred among the patients who were ill less than 10 days. No report has been found similar to our case with recovery from the acute illness within 12 hours and an uneventful convalescence.

Therapy.—Supportive measures such as maintenance of fluid and electrolyte balance, reduction of fever by ice packs to head, body, and

extremities and ice water enemata, blood transfusions, and administration of oxygen are as necessary today as they were before the introduction of penicillin. The course of the disease as well as the mortality rate was little affected by any previous form of treatment including sulfa, toxin, or toxoid preparations (5) (16), or vaccines. Some of these agents are of questionable value. The only additional therapy which could account for the remarkable change in the course and prognosis as observed in our case was the immediate and intensive treatment with penicillin.

Penicillin is the most effective drug at the present time for the treatment of staphylococcus infections. However, Spink and his co-workers (15) report that 12 percent of 68 strains of coagulase-positive staphylococci isolated from patients were relatively resistant to penicillin. Further, sensitive strains may become penicillin-resistant due to inadequate amounts of penicillin, but this fastness may be only temporary and may be overcome by larger doses of penicillin. A gradual increase in ineffective small dosages of penicillin likewise contributes to the development of resistant organisms. An adequate plasma level of penicillin for most serious infections can be supplied by 200,000 to 300,000 units intramuscularly over a 24-hour period (15). We attribute the dramatic results in our case to the initial four 50,000-unit doses of penicillin with a total 24-hour dosage of 280,000 units. This response to initial large doses probably prevented the development of penicillin-fast organisms (11).

Intramuscular injections of concentrated large doses of penicillin present no difficulties. We have had no complaints of soreness except from the introduction of the needle and have observed no evidence of local reactions. Many patients have received as many as 60 successive injections of 40,000 units in 2 cc. physiologic salt solution who, on specific questioning, have denied any discomfort or pain except from the needle or transient pressure of the injected solution. We routinely administer penicillin in 2 cc. physiologic salt solution, regardless of the size of the dose.

There has been a tendency to think of penicillin dosages as originally recommended when the drug was scarce and the value and limitation of the drug were being studied. At the present time 40,000- and 50,000-unit doses are commonly used without local or systemic complaint or ill effect, and still larger doses are being used satisfactorily. The course of the disease when treated with large initial doses of penicillin is in striking contrast to the course of a postoperative *S. aureus* infection initially treated with 10,000- and then 20,000-unit doses of penicillin. This is illustrated in the temperature curve of figure 2. No improvement occurred until 6 hours after 50,000-unit doses were started, at which time the patient became afebrile and thereafter had

an uneventful convalescence. The dosage of penicillin must be sufficient to produce the maximum effect on as many organisms in the shortest period of time (11), (15). This must be accomplished by much larger initial doses of penicillin than 5,000-, 10,000-, or 20,000-unit doses generally recommended, the dose depending upon the organism present and the severity of the symptoms.

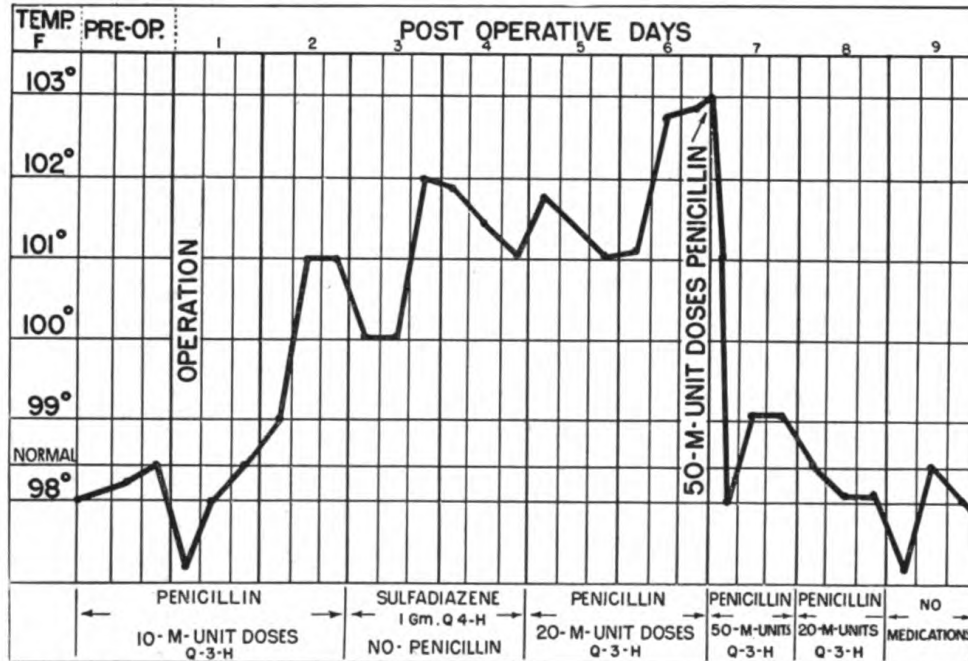


FIGURE 2.—Temperature curve of postoperative pilonidal *S. aureus* infection following ineffective 10,000- and then 20,000-unit doses of penicillin and for 2 days sulfadiazine, 1 gram every 4 hours, which was also ineffective. Three months prior to operation, treatment with sulfadiazine and warm hypertonic magnesium sulfate dressings were successful in controlling a serious infection of the pilonidal area and for 2 months the pilonidal sinus remained quiescent. At the height of the infection on the sixth postoperative day (temperature 103° F.), 50,000-unit doses of penicillin in 2-cc. physiologic salt solution were given intramuscularly every 3 hours for 4 doses. The temperature promptly dropped to normal (6 hours) and uneventful convalescence followed.

Surgical trauma of a local infection is an important etiologic factor in bacteremia or septicemia. Eight of the 31 cases reviewed followed surgical incision of an abscess. However, the continued presence of a bacteremia as demonstrated by repeated positive blood cultures indicates persistent source of infection and lack of drainage. As in the case of Herbst and Merricks (7) such findings required surgical drainage of an abscess before recovery occurred. When a local infection accompanied by systemic symptoms and signs of septicemia is present, surgical drainage may be required.

Prognosis.—Penicillin therapy has produced a marked reduction in the mortality rate as well as the morbidity. As a result of the prompt

response to early and adequate treatment fewer complications will occur from bacteremia. Therefore, prolonged convalescence will be avoided from secondary abscesses, osteomyelitis, kidney, lung and other visceral infections, and the general debility which follows chronic sepsis.

SUMMARY AND CONCLUSIONS

1. A case of fulminating hemolytic *S. aureus* infection with extreme hyperpyrexia is reported. Remarkable recovery occurred within 12 hours following 50,000-unit doses of penicillin.

2. The frequency of positive blood cultures and of the development of secondary metastatic foci of infection will be reduced by the rapid bacteriostatic action and the prompt recovery following penicillin treatment.

3. Diagnosis is made on the clinical evidence of systemic infection, with or without demonstrable bacteremia. Smears and cultures of the primary lesions are more necessary to establish the causative organisms than the uncertainty of obtaining positive blood cultures.

4. Immediate and intensive penicillin therapy should be instituted without waiting for the results of laboratory diagnostic procedures. Inadequate dosages will contribute to the development of penicillin-fast organisms.

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INFECTIVITY OF MALARIAS OF FOREIGN ORIGIN TO ANOPHELINES OF THE SOUTHERN UNITED STATES

Authors' summary and conclusions.—1. The infectivity of malaras of foreign origin relapsing in returned soldiers to anophelines of the southern United States was investigated. A total of 173 lots of *Anopheles quadrimaculatus* was fed on soldiers with relapsing *Plasmodium vivax* infection. The origins of the infections were: South Pacific, 117; Mediterranean, 40; Caribbean, 6; Liberia, 1; Burma, 1.

2. Malaras from each of the above areas infected *A. quadrimaculatus*; 61 percent of the cases infected mosquitoes. The rate of infection in the total 6,247 mosquitoes dissected was 30.8 percent.

3. *A. quadrimaculatus* successfully transmitted these infections to man. These foreign malaras induced in neurosyphilitic patients were also infective to *A. quadrimaculatus*, and continued to be so through several serial transfers both by mosquito bites and blood inoculations.

9. Mosquitoes kept at outdoor temperatures in Texas during April and May developed infections at about the same rate as those kept in the insectary. During April the infections developed more slowly outdoors.

10. Abnormal sporozoites appeared in some of the mosquito glands. These were correlated with a fungus concomitantly infecting the mosquitoes.—YOUNG, M. D., STUBBS, T. H., ELLIS, J. M., BURGESS, R. W. and EYLES, D. E.: Studies on imported malaras; (4) infectivity of malaras of foreign origin to anophelines of southern United States. *Am. J. Hyg.* **43**: 326-341, May 1946.

MEDICAL AND SURGICAL DEVICES



AN IMPROVED SEPARATING MEDIUM FOR ACRYLIC RESIN ¹

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One of the most discouraging and disheartening phases of an exacting acrylic technique is that of the separating medium. Tinfoil was the original separator applied to casts prior to the processing of the acrylic. Tinfoiling a cast is a time-consuming, skill-requiring job but, properly done, produces the hardest, most desirable surface possible on the finished product.

The lead-tinfoil, marketed as a substitute for tinfoil during the war, failed to live up to expectations. Tears in it were frequent, and proper adaptation to the cast was almost impossible. At first, perplexing and later embarrassing, was the fact that the denture material, processed in contact with the lead foil, took on a bluish-black discoloration.

Cellophane as a separating medium produced wrinkles in the base and at the borders. Faults and underextended borders also appeared periodically, thus leading to its discard as a satisfactory separating medium.

The cellophane cycle was followed by that of the alginate. Variance in viscosity, and in the number of coats required for complete separation soon convinced us that alginate also had its shortcomings. Border discrepancies caused by the tendency of alginate to pool, and frequent lack of complete separation of acrylic and cast, kept alive the search for a better separator.

We now believe the final answer is the use of a thin sheet of rubber similar in thickness and texture to that found in the ordinary rubber protective sheath. The sheath is cut lengthwise giving a sheet of rubber of extreme thinness and about 5 inches square. A holder or

¹ From U. S. Naval Dental School, National Naval Medical Center, Bethesda, Maryland.

stretcher is formed by cutting a laboratory wire mesh or screen to be $\frac{1}{4}$ inch larger than the bottom of a prosthetic flask (fig. 1A).

The case is packed with the acrylic dough and then trimmed for final closure in the usual manner. The stone cast and surrounding investment in the lower half of the flask are now thoroughly lubricated with petrolatum. The wire holder is placed under this part of flask and the rubber sheet stretched over the cast and hooked onto the projecting points of wire (fig. 1B). The flask is now closed (fig. 1C) and the case is processed with the rubber sheet and holder in position.

Upon opening the flask, the rubber sheet peels off leaving an acrylic surface entirely free of stone, perfectly adapted and free from all wrinkles (fig. 1D).

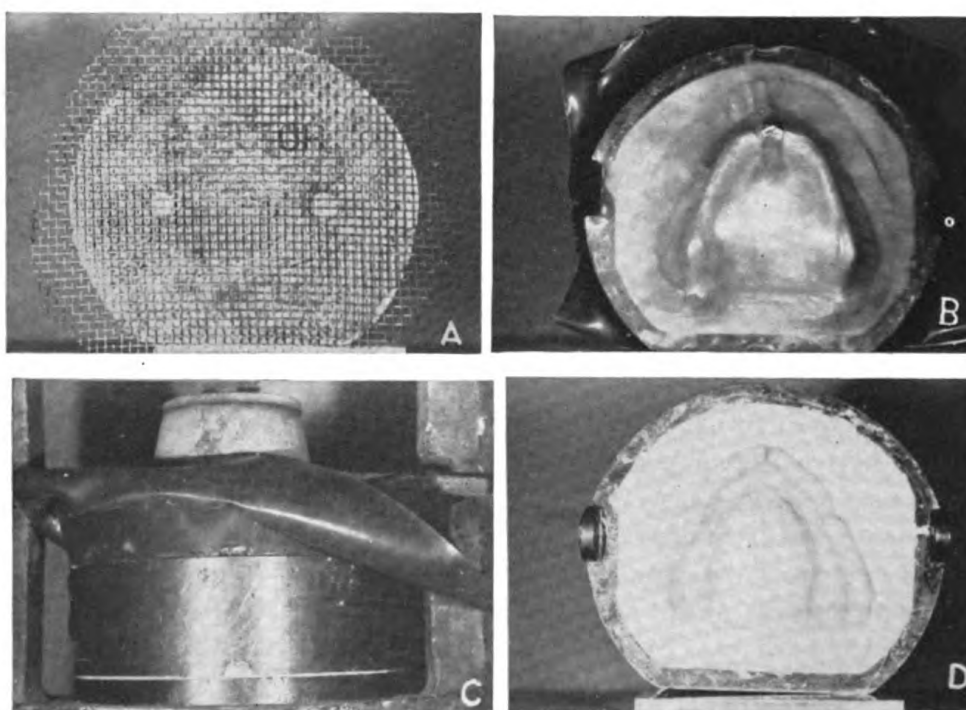


FIGURE 1.—(A) Wire screen on holder trimmed one-fourth inch larger than flask.
(B) Rubber sheet held in place over cast after case has been packed.
(C) Flask closed and ready for processing. Note rubber sheet in position.
(D) Flask separated after processing. Rubber dam peeled off.



BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

WHITE HOUSE PHYSICIAN, by *Ross T McIntire, Vice Admiral, Medical Corps, Surgeon General, U. S. Navy, in collaboration with George Creel.* 244 pages. G. P. Putnam Sons, New York, 1946. Price \$3.

THE WHITE HOUSE during much of the twelve-year period about which Admiral McIntire writes, was more than the center of National affairs; it was the center of World affairs as well. It, therefore, covers a time when President Roosevelt was not only a national leader, but a world leader of unusual stature and fame. This book for that reason alone possesses a special interest.

In a pleasant and modest chapter Dr. McIntire tells how he came to be chosen for the difficult task of medical adviser to the President and the diffidence with which he approached it. He describes well the friendly and helpful attitude of the immediate official and personal family of the President who assisted him not only at the beginning of his duties but throughout the whole of his time as White House Physician.

The book in the main concerns itself with three subjects. The first is an account of the great events and the great personalities with which he was associated. The second deals with the medical history of the President and replies unequivocally to the charges made in the press that the true state of his health was not made public. The third brings out the courage and determination which made his famous patient triumph over a handicap that would have been insurmountable for most people.

The great events—and the great men and women too—were so numerous that only a few are described. Furthermore, there were many situations so delicate from the standpoint of both personal and national repercussions that they could not be told at the present time.

Of those the author has made mention, some are not without amusing aspects and add a touch of humor to some of the scenes.

The charges in the press that the state of the President's health at the time of the 1944 election was not fully placed before the people is answered in a clear and explicit manner by Dr. McIntire. He quotes from the actual findings of the careful physical examinations in which several prominent specialists were called in consultation in order to determine the President's exact condition. The findings indicated that though tired and worn by the 12 years of heavy responsibilities and constant demands made upon his energies he had no serious organic condition. It was felt that with a regime that would restrict somewhat his activities and conserve his strength he had a good chance to go through the fourth term as well as the preceding one. He was 63 years of age. He was, however, as Dr. McIntire stated to the press, "in excellent condition for a man of his age." He repeats the statement in this book and declares with conviction that he *stands by that judgment today without amendment or apology*. There was no doubt that he believed the President would win through as he had done in the past.

He was justified too in this opinion by the fact that the tremendous vitality and courage of the President had already been demonstrated in his fight against poliomyelitis. Mr. Roosevelt is perhaps the most famous of infantile paralysis patients and the account of his case is one of the most interesting features of the book. Quoted is a letter from Mr. Roosevelt written to Dr. William Eggleston of Hartsville, S. C., in 1924 and published in 1946 in the Journal of the South Carolina Medical Association which is a remarkable document, both for its human interest, and because it gives some very sound medical advice that was in advance of the general medical knowledge of the subject at the time the letter was written. Well brought out also is the part played by fatigue and exposure as a contributory cause of the disease. The President's case occurred after an exhausting day of sailing and firefighting while on a vacation in the Canadian woods in 1921.

Nowhere does the courage of Mr. Roosevelt show to greater advantage than in the story of his fight against the suffering and the crippling effects of infantile paralysis. We are proud of our log cabin Presidents because their rise showed the resolution and abilities which carried them from poverty to the highest position in the land. Here we have a victory over a handicap greater even than that of poverty. Certainly there are few men who would not have given up any career save that of a wheel chair, yet this man became Governor of New York and President of the United States. This successful struggle against a crippling disease has alone made him a heroic figure.

His example gave and will continue to give courage and hope to thousands stricken like himself. Dr. McIntire's book contains probably the best account of this side of the President, including his part in the establishment of the Warm Springs Foundation and his interest in research directed to the prevention and treatment of infantile paralysis.

THE HUMAN EAR IN ANATOMICAL TRANSPARENCIES by *Stephen L. Polyak, M. D., Professor of Anatomy, The University of Chicago; Anatomical transparencies and illustrations, Gladys McHugh, Medical Illustrator, The University of Chicago Clinics; Anatomic preparations, Delbert K. Judd, M. D., Assistant Professor Otolaryngology, The University of Chicago.* 136 pages, numerous illustrations. Sonotone Corporation, Elmsford, New York, N. Y., 1946. Price \$10.50.

This is an anatomical atlas of the human ear. It is distinguished by the excellence of the anatomical preparations and the beautiful illustration of them. It is accompanied by an excellent anatomical text by Dr. Polyak.

An ingenious feature is the use of the so-called anatomic transparencies which are so arranged that each represents frontal or sagittal sections superimposed upon one another. Thus as the successive pages are turned, deeper and deeper layers of the tissue are revealed. The most exact and minute anatomy can thus be traced from the skin surface inward.

Miss McHugh's other paintings are beautiful. Nearly all of the illustrations are from the original dissections by Dr. Judd; however, a number of black and white drawings are from other sources. For the otolaryngologist, this book should be a reference work of the greatest value.

OPHTHALMOLOGY IN THE WAR YEARS, edited by *Meyer Wiener, M. D.* 1,166 pages. The Year Book Publishers Inc., Chicago, Ill., 1946. Price \$13.50.

Volume one of Ophthalmology in the War Years is an encyclopedic review of all ophthalmologic literature published from 1940-1943 inclusive. The idea behind this worthwhile publication was that during the war years some men in uniform did not have ready access to ophthalmologic literature because of constantly changing duty stations and the men at home were so unusually busy that they were unable to keep up with their accustomed reading.

The bibliography accompanying each review is extensive and appears to be complete.

Ophthalmologists will find this volume indispensable and an easy way to catch up with neglected reading. This volume is an essential for one writing an article on an ophthalmologic topic. It would be a good idea to publish these exhaustive summaries even during the peace years.

THE NORMAL ENCEPHALOGRAM by *Leo M. Davidoff, M. D., F. A. C. S., Chief, Department Surgery, Attending Neurological Surgeon, Jewish Hospital of Brooklyn, and Cornelius G. Dyke, M. D., F. A. C. R., Late Associate Professor of Radiology, The College of Physicians and Surgeons, Columbia University, New York City.* 2d edition. 232 pages, illustrated with 155 engravings. Lea & Febiger Co., Philadelphia, Pa., publishers, 1946. Price \$5.50.

This is a beautifully illustrated, thoroughly revised edition of a valuable publication. The indications for and technique of encephalography are briefly and clearly described. The remainder of the book is devoted to a detailed analysis of the topography of the brain and adjacent tissues and spaces as reflected on the encephalogram. The author's conservative, scientific approach to the subject commands respect for his observations and conclusions based on 8,000 encephalographic studies. No one engaged in performing or interpreting encephalograms should be without this book.

HIPPOCRATIC WISDOM, A Modern Appreciation of Ancient Scientific Achievement, by *William F. Petersen, M. D.* 263 pages; numerous illustrations. Charles C Thomas, Springfield, Ill., publishers, 1946. Price \$5.

This is a well printed book and the head pieces and tail pieces of each chapter are attractive reproductions of antique statuettes, medals, medical charms or scenes. The book is made up of a series of quotations from the Hippocratic writings followed by the comments of the author. Dr. Petersen has long been known for his interest in the relation between climate and weather and disease, and it is therefore natural that he should have started with *Airs, Waters, and Places*, one of the most interesting of the Hippocratic books. We refer to Hippocratic wisdom and we ourselves would be wise to heed the words of one of the greatest thinkers of antiquity. There is little doubt, as Dr. Petersen points out, we often look only toward some of the causes of disease such as bacteria, parasites, or viruses, and disregard the constitution of the patient and the social and environmental causes, including climate and weather.

A number of the famous case reports of Hippocrates are quoted and placed in opposition to them are a number of modern cases. The remarkable clarity of the old Greek descriptions makes the diagnosis of the cases fairly easy even today. In the final chapter, attention is drawn to the production of genius in the Golden Age of Greece and its relationship to a double sun spot period. The author ends on a pessimistic note—a feeling that perhaps our own civilization like that of Athens is about to deteriorate.

The appendix of the book is extensive and consists of many interesting notes on early Greece and early Greek medicine. The illustrations, typography, and format are particularly fine.

DIABETES, a Concise Presentation, by *Henry J. John, Lt. Col., M. C., U. S. A.; M. A., M. D., F. A. C. P.* 300 pages; illustrated. The C. V. Mosby Company, St. Louis, Mo., publishers, 1946. Price \$3.25.

Dr. John is known as the author of an excellent diabetes manual. The present book is a brief but very inclusive presentation of the whole subject of the diagnosis and treatment of diabetes. A very interesting chapter is one on the prevention of the disease, not usually thought of as a preventible. Another useful subject treated at length are exacerbations and their control. The question of surgery, diabetes in children, in pregnancy, and the various complications of the disease are well covered. A long chapter on "Do's and Don't's" is a practical feature. Some fine graphs in color showing carbohydrate, fat, protein, water, and ash content of foods are included in the section on diets. There is a very good bibliography and index. A valuable little book which every doctor should have on his bookshelf, and frequently on his desk.

PHYSICAL DIAGNOSIS by *Ralph H. Major, M. D., Professor of Medicine, University of Kansas School of Medicine.* 3d edition, revised. 444 pages; 457 illustrations. W. B. Saunders Company, Philadelphia, Pa., publishers, 1945. Price \$5.

This book is well printed on heavy gloss paper. The type is clear and easily read. The illustrations accompany the descriptions in the text and are clear cut, easily understood and instructive. Many illustrations are unusual, extraordinary, and evidently original photographs of patients.

The contents are systematically arranged under headings and sub-headings permitting easy access to the subject matter. The text is written in a manner that encourages reading and study by the student as well as the general practitioner. Much detail of symptomatology is stated in reference to the findings upon physical examination. For instance there is a discussion of pain which brings out many interesting relationships.

General inspection is extensively dealt with. The several regions and parts of the body are covered in considerable detail. The examination of the chest itself is very complete. The lungs and heart are treated separately from the chest and very fully. Auscultation of the lungs and heart have each a separate chapter, while there is another chapter dealing especially with physical findings in relation to diseases of the lungs and similarly in relation to cardiovascular diseases. Separate chapters cover the pulse and blood pressure.

Considerable space and many illustrations are devoted to the extremities and much valuable detail is presented that is exceedingly helpful to the student. A worthwhile chapter describes what the author states is "merely an outline" of a neurological examination, yet the procedure is well covered in essential details and findings sufficient at least for the student.

The illustrations throughout the book convey to the eye appearances and pictures that can easily be remembered or recalled. Exam-

ination procedures, tests, and diagrammatic sketches are well shown. Together the illustrations and examination procedures emphasize the cases in point and should serve the student in good stead.

The book is commended to the use of students.

TREATMENT OF BRONCHIAL ASTHMA by Vincent J. Derbes, M. D., *Instructor in Medicine and in Preventive Medicine, Tulane University of Louisiana School of Medicine; Assistant Visiting Physician, Charity Hospital of Louisiana; Director of the Department of Allergy, Ochsner Clinic; Fellow, American College of Allergy; Member, American Academy of Allergy; and Hugo Tristram Engelhardt, M. D., F. A. C. P., Instructor in Clinical Medicine, Baylor University College of Medicine, Houston, Texas; Physician, Humble Oil and Refining Company, Houston Texas; Adjunct in Medicine, Jefferson Davis Hospital, Houston, Texas; Formerly Instructor in Medicine, Tulane University of Louisiana School of Medicine, and Visiting Physician, Charity Hospital, New Orleans, Louisiana; Fellow, American College of Allergists.* 466 pages; 61 illustrations. J. B. Lippincott Company, Philadelphia, Pa., publisher, 1946. Price \$8.

This book was written from the standpoint of assisting the general practitioner in dealing with one of the diseases commonly seen in family practice. While the fundamental knowledge of anatomy, physiology, allergic agents, psychogenic factors and those of weather and climate are covered, the greatest emphasis has been put on practical methods of treatment and the book is appropriately named.

In no disease is the search for causative agents and their removal more important than in asthma and the methods of diagnosis to determine the factors responsible for the individual case are given in detail and in such a way that there can be no mistake as to the technique to be followed. The illustrations are clear and there are a number of good pollen maps.

It is one of the few books on the subject this reviewer has seen that gives proper emphasis to inhalation therapy of adrenalin over the injection of this drug, a subject long neglected in textbooks and not well known to the general practitioner.

NOT BY BREAD ALONE, by Vilhjalmur Stefansson. 339 pages; no illustrations. The Macmillan Company, New York, N. Y., publishers, 1946. Price \$3.50.

The vegetarian is a well-known figure but if Mr. Stefansson's views were widely adopted we would have to coin a new word, probably "carnivarian." For the thesis of this book is that man is really carnivorous and, when food is restricted, as on exploring or other expeditions, does best on an all-meat diet.

A distinguished Arctic explorer, he writes a most interesting book around this thesis with many examples and experiences of his own and other Arctic travelers. Almost the last half of the book revolves around the making and use of pemmican, regarded by him as the perfect food for emergency rations as life and health can be maintained

indefinitely on it when away from the food resources of settled areas.

Stefansson spent 5 years in the Arctic, at one time living almost exclusively on meat. He lived a year in this country on a meat ration and under medical supervision to determine the effects. In 1926 Dr. Clarence W. Lieb, the gastroenterologist, examined Stefansson and published the result in the *Journal of the American Medical Association* (July 3, 1926) under the title "The Effects of an Exclusive Long Continued Meat Diet." He found no ill effects. The other test was carried on by Dr. DuBois, now Professor of Physiology at the Medical College, Cornell University.

Of course Mr. Stefansson does not recommend the meat diet for everyone for several reasons. It is expensive and also the supply would soon be exhausted. Even a black market would not be able to meet the demand. Religious and social customs and beliefs would interfere. But as to its value as an emergency food the arguments presented are valuable, particularly now when the Polar areas are coming into prominence, both as future habitation zones and possible war theaters.



DETERMINATIONS OF ANTI-INFECTIOUS PROPERTIES OF TULAREMIA SERA

The protective property of antitularemia sera prepared by different methods was tested by the simultaneous intramuscular injection of a sera and cultures into mice. The best protection (80 percent) was given by sera of horses immunized with live, virulent cultures. Sera from animals immunized with formalized or lysed antigens were ineffective or poorly effective. The agglutination titer did not always reflect the protective power of the serum.—VERENINOVA, N. K., DENISENKO, L. K., and KURSHEVA, A. N.: Serotherapeutics of tularemia; (1) determination of the anti-infectious properties of tularemia sera. *Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii* (Moscow) 1943 (7/8): 28-32, 1943; *Biol. Abstr.* 20: 941, May 1946.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS EMPLOYED IN THE TREATMENT OF SYPHILIS
IN THE UNITED STATES NAVY, 1945

OTTO L. BURTON
Captain (MC) U. S. N.

GEORGE W. JUSTYN
Chief Pharmacist U. S. N.

and

LAURA T. ANDERSON

Since 1925, medical officers of the Navy have been required to submit an annual report showing the number of persons who have or have had a history of syphilis, the number of persons treated during the calendar year, and the number of doses of each arsenical (and since 1945 the number of courses of penicillin) administered in the treatment of syphilis during the calendar year. A separate report of each case in which ill effects are noted is also required. During the 21 years 1925 to 1945 inclusive, in which this information has been compiled, 2,667,472 doses of arsenicals have been administered and 1,323 untoward reactions have been reported. A total of 7,441 courses of penicillin was used in the treatment of syphilis in 1945.

Previous articles dealing with this information have been published in the following issues of the U. S. NAVAL MEDICAL BULLETIN:

September 1925	January 1935	January 1939	January 1943
January 1927	October 1935	October 1939	November 1943
January 1929	January 1936	January 1940	January 1944
July 1930	October 1936	October 1940	October 1944
October 1931	January 1937	January 1941	January 1945
October 1932	October 1937	October 1941	October 1945
October 1933	January 1938	January 1942	January 1946
October 1934	October 1938	October 1942	November 1946

Cases of arsenical dermatitis occurring during the year 1945 were reported in the November 1946 issue of the U. S. NAVAL MEDICAL BULLETIN.

The present article includes all cases, except those of arsenical dermatitis, that were reported during the year 1945. Comparative figures from the experience of previous years are also presented.

NUMBER OF PERSONS TREATED FOR SYPHILIS

Annually, on 31 December, each activity reports to the Bureau of Medicines and Surgery, on Form NAVMED A, the number of persons in that command who have or have had a history of syphilis, and the number receiving any anti-syphilitic treatment during the year. This census does not take into account persons who left the service during the year.

In table 7 treatment data are listed separately for "active service personnel (Negro and all other)" and "other personnel." The term "other personnel" includes Veterans' Administration patients, dependents of naval personnel, native populations of insular possessions, and prisoners of war.

TABLE 1.—*Arsenical reactions, 1945*

Classification	Mapharsen and neoarsphenamine ^a			
	Mild	Severe	Fatal	Total
Arsenical dermatitis ¹	5	6	0	11
Reactions of minor importance	11	0	0	11
Liver damage	0	1	2	3
Arsenical hypersensitivity	8	1	0	9
Vasomotor phenomena	0	3	0	3
Blood dyscrasias	0	2	0	2
Liver damage (doubtful reaction)	0	1	0	1
Arsenical neuritis	1	0	0	1
Gastro-intestinal disturbance	1	0	0	1
Total	26	14	2	42

¹ Case histories were published in the November 1946 issue of the U. S. NAVAL MEDICAL BULLETIN. 38 of the above reactions (25 mild, 12 severe, and 1 fatal) were caused by mapharsen. 4 (1 mild, 2 severe, and 1 fatal) were caused by neoarsphenamine.

TABLE 2.—*Arsenicals administered during the year 1945 for syphilis, and arsenicals administered during the 14-year period, 1932-45*

Drug	Doses	
	1945	14-year period 1932-45
Acetarsonic:		
Navy	0	166
Other personnel	0	847
Arsphenamine:		
Navy	0	10,446
Other personnel	0	713
Bismarson:		
Navy	(¹)	2,820
Other personnel	(¹)	1,934
Mapharsen: ²		
Navy	95,587	1,026,677
Other personnel	13,335	89,193
Neoarsphenamine:		
Navy	2,007	720,340
Other personnel	23	178,982
Silver arsphenamine:		
Navy	16	371
Other personnel	0	204
Sulfarsphenamine:		
Navy	11	7,937
Other personnel	109	14,051
Tryparsamide:		
Navy	358	39,141
Other personnel	32	18,728
Total	111,478	2,112,550

¹ Not indicated, as many commands reported bismuth as bismarsen.

² First administered in 1935.

TABLE 3.—*Penicillin administered for syphilis during the year 1945*

	Courses ¹
Penicillin:	
Navy.....	7,019
Other personnel.....	422
Total.....	7,441

¹ Course consisted of 2,400,000 units.

TABLE 4.—*Deaths and severe reactions following the administration of 1,394,868 doses of neoarsphenamine, 1925-45; ratio of deaths and severe reactions to doses*

Classification	Deaths		Severe reactions		Total deaths and severe reactions	
	Num-ber	Ratio to doses: 1 to—	Num-ber	Ratio to doses: 1 to—	Num-ber	Ratio to doses: 1 to—
Hemorrhagic encephalitis.....	18	77,493	1	1,394,868	19	73,414
Arsenical dermatitis.....	13	107,298	216	6,458	229	6,091
Blood dyscrasias.....	9	154,985	20	69,743	29	48,099
Vasomotor phenomena.....	6	232,478	57	24,471	63	22,141
Acute renal damage.....	2	697,434	5	278,974	7	184,081
Acute yellow atrophy of the liver.....	2	697,434	0	—	2	697,434
Vascular damage (probable renal hemorrhage).....	1	1,394,868	0	—	1	1,394,868
Liver damage.....	2	697,434	28	49,817	30	46,496
Jarisch-Herxheimer reaction.....	0	—	2	697,434	2	697,434
Gastro-intestinal disturbance.....	0	—	5	278,974	5	278,974
Polynuritis.....	0	—	1	1,394,868	1	1,394,868
Borderline hemorrhagic encephalitis.....	0	—	1	1,394,868	1	1,394,868
Arsenical neuritis.....	0	—	1	1,394,868	1	1,394,868
Optic neuritis.....	0	—	1	1,394,868	1	1,394,868
Arsenical hypersensitivity.....	1	1,394,868	0	—	1	1,394,868
Classification undetermined.....	1	1,394,868	0	—	1	1,394,868
Total.....	55	25,361	338	4,127	393	3,549

TABLE 5.—*Deaths and severe reactions following the administration of 1,115,873 doses of mapharsen, 1935-45; ratio of deaths and severe reactions to doses*

Classification	Deaths		Severe reactions		Total deaths and severe reactions	
	Num-ber	Ratio to doses: 1 to—	Num-ber	Ratio to doses: 1 to—	Num-ber	Ratio to doses: 1 to—
Arsenical dermatitis.....	0	—	41	27,216	41	27,216
Liver damage.....	1	1,115,873	21	53,137	22	50,722
Vasomotor phenomena.....	0	—	6	185,979	6	185,979
Acute renal damage.....	2	557,937	0	—	2	557,937
Toxic encephalopathy.....	2	557,937	0	—	2	557,937
Blood dyscrasia.....	0	—	3	371,958	3	371,958
Hemorrhagic encephalitis.....	1	1,115,873	0	—	1	1,115,873
Polynuritis.....	0	—	1	1,115,873	1	1,115,873
Arsenical hypersensitivity.....	0	—	2	557,937	2	557,937
Febrile reaction.....	0	—	1	1,115,873	1	1,115,873
Circulatory collapse.....	1	1,115,873	0	—	1	1,115,873
Total.....	7	159,410	75	14,878	82	13,608

TABLE 6.—Deaths following administration of arsenical compounds, 1919-45

Year	Arsphenamine	Neoarsphenamine	Silver arsphenamine	Mapharsen	Total
1919.....	3	0	0	0	3
1920.....	1	1	0	0	2
1921.....	3	1	0	0	4
1922.....	0	4	0	0	4
1923.....	0	1	0	0	1
1924.....	1	2	0	0	3
1925.....	0	2	0	0	2
1926.....	0	4	0	0	4
1927.....	1	4	0	0	5
1928.....	0	6	0	0	6
1929.....	0	3	0	0	3
1930.....	0	3	0	0	3
1931.....	0	0	0	0	0
1932.....	0	4	0	0	4
1933.....	0	7	0	0	7
1934.....	0	3	0	0	3
1935.....	0	2	0	0	2
1936.....	0	3	0	0	3
1937.....	0	1	0	0	1
1938.....	0	3	0	0	3
1939.....	0	4	0	0	4
1940.....	0	1	0	0	1
1941.....	0	0	0	1	1
1942.....	0	0	1	0	1
1943.....	0	1	0	0	1
1944.....	0	3	0	5	8
1945.....	0	1	0	1	2
Total.....	9	64	1	7	81

TABLE 7.—Syphilis, arsenicals and penicillin, U. S. Navy, 1945

Item	Persons			Total
	Navy and Marine Corps		Other personnel	
	Negro	All other		
Syphilis census, 31 Dec. 1945.....	3, 315	11, 714	-----	¹ 16, 138
Number of persons treated for syphilis with—				
Arsenicals:				
Bismarsen.....	(²)	(²)	(²)	(²)
Mapharsen.....	1, 379	2, 154	640	³ 4, 634
Neoarsphenamine.....	43	88	3	⁴ 137
Sulfarsphenamine.....	0	2	2	4
Silver arsphenamine.....	2	1	0	3
Tryparsamide.....	2	24	7	33
Total persons treated with arsenicals.....	1, 426	2, 269	652	⁵ 4, 811
Penicillin.....	1, 391	2, 260	145	⁶ 3, 903

¹ Data incomplete. Total includes 1,079 cases not broken down into Negro and all other.² Not indicated, as many commands reported bismuth as bismarsen.³ Total includes 461 persons not broken down into Negro and all other.⁴ Total includes 3 persons not broken down into Negro and all other.⁵ Total includes 464 persons not broken down into Negro and all other.⁶ Total includes 107 persons treated with penicillin and not broken down into Negro and all other.

MAPHARSEN

ARSENICAL HYPERSENSITIVITY

Case 12-1945.—This patient developed a penile lesion and inguinal adenopathy following exposure to infection in April 1943. Darkfield examination and Kahn blood reaction were negative on 15 July. The Kahn blood reaction was 4-plus on 9 August 1943 and negative on 20 April 1944. The following antiluetic therapy was administered: Mapharsen, 31 injections, a total of 1.83 grams, from 14 August 1943 to 10 March 1944; bismuth, 9 injections, a total of 1.59 grams, from 14 August 1943 to 22 January 1944; mapharsen, thirty-one 0.06-gram injections, from 11 April 1944 to 9 January 1945; and bismuth, fourteen 0.2-gram injections, from 28 March 1944 to 17 October 1944. The reaction occurred 9 January 1945, 30 seconds after the thirty-first mapharsen injection. Within 2 minutes, the patient had extreme sensations of hyperpyrexia, back pain, headache, and smothering. Physical examination revealed flushed face, neck, and trunk; dilated pupils, injected conjunctivae; marked dyspnea; and warm dry skin. Pulse slow and of good quality; temperature 99° F.; blood pressure 118/64. Patient extremely agitated, nervous, trembling, and in a state of excitement. Repeated urinalyses showed a specific gravity of 1.016, albumin negative, sugar negative, and microscopic negative.

Treatment for the reaction consisted of 1:1000 solution of epinephrine, $\frac{1}{2}$ cc. immediately, 10 cc. of sodium thiosulfate intravenously 10 minutes after the reaction, morphine sulfate, $\frac{1}{8}$ grain, $\frac{1}{2}$ hour after reaction, and 10 cc. of sodium thiosulfate 6 hours after the reaction.

Recovery was complete in 8 hours. The patient, however, was kept in the sick bay under observation for 7 days. No late symptoms developed.

Case 13-1945.—After exposure to infection on 20 August 1943, this patient developed a penile lesion and inguinal adenopathy. Darkfield examination was positive and a Kahn blood reaction was 2-plus on 9 October. Kahn blood tests on 16 November 1943 and 13 April 1944 were negative. From 14 October 1943 to 4 February 1944, the patient received 20 injections of mapharsen, a total of 1.20 grams, and 5 injections of bismuth, a total of 0.88 gram; from 28 March to 1 November 1944, twelve 0.2-gram injections of bismuth; and from 11 April 1944 to 9 January 1945, twenty-nine 0.06-gram injections of mapharsen.

Thirty seconds after the injection of mapharsen on 9 January 1945, the patient lost consciousness for about 2 minutes. Pulse was regular and strong and the face and neck were flushed. On becoming conscious the patient was in an extremely nervous condition, rational but agitated, and unable to lie quietly. Chief complaints were hyperpyrexia, smothering, and tightness in chest. Physical examination revealed flushed face and neck, dilated pupils, marked dyspnea, temperature 99.4° F., blood pressure 98/58, pulse 74 and of good quality, and skin and mouth dry.

Repeated urinalyses showed a specific gravity of 1.018, albumin negative, sugar negative and microscopic negative.

Treatment for the reaction consisted of 1:1000 solution of epinephrine, $\frac{1}{2}$ cc. immediately, 10 cc. of sodium thiosulfate, intravenously 10 minutes after the reaction, morphine sulfate, $\frac{1}{8}$ grain, $\frac{1}{2}$ hour after reaction, and 10 cc. of sodium thiosulfate 6 hours after the reaction.

Recovery was complete in 8 hours. The patient, however, was kept in the sick bay under observation for 7 days. No late symptoms developed.

Case 14-1945.—The history of exposure to syphilitic infection in this case is unknown. Kahn blood reaction was positive in October 1944 while the patient was hospitalized for the excision of a pilonidal cyst. A second positive Kahn blood test was recorded and arsenical treatment was instituted without further evidence of infection. Twenty 0.06-gram injections of mapharsen were given at biweekly intervals between 17 October 1944 and 26 January 1945 and sixteen 0.06-gram injections at semiweekly intervals between 25 March and 28 May. Four courses of bismuth subsalicylate in oil were given: the first course consisted of 5 injections between 20 October and 22 November 1944; the second consisted of 3 injections between 13 December and 27 December 1944; the third course consisted of 6 injections between 29 January and 1 March 1945; and the fourth course, begun on 13 May 1945, was still in progress on 28 May 1945. All bismuth injections consisted of 0.5 gram. To date of reaction the patient had received 2.16 grams of mapharsen and 8.5 grams of bismuth. On 28 May, 45 minutes after the injection of mapharsen, the patient suddenly experienced nausea, vertigo, weakness, diarrhea, dyspnea, and some tingling of the hands and fingers. Physical examination revealed a rapid pulse, normal blood pressure, and a slightly elevated temperature. The patient was apprehensive, sweating profusely, but of good color. Chest was clear. He experienced a shaking chill of several minutes' duration. The vomiting and retching continued for about 1 hour and the respiratory distress subsided rapidly. The patient became drowsy after his anxiety subsided. The blood count was normal. Urine examinations were normal and revealed no hemoglobin on the day of or the day following the reaction.

Treatment for the reaction consisted of intravenous infusion of 1,000 cc. of dextrose in saline solution administered immediately and sodium amytal, 3 grains, after the vomiting had subsided.

Except for a feeling of weakness, recovery was complete in 12 hours.

Case 15-1945.—The history of exposure to infection in this case is unknown. The patient was hospitalized on 25 January 1945 with a diagnosis of phimosis. History and examination revealed a small lesion on glans near sulcus, edema of glans, a tight phimosis, and a retracted prepuce. Several darkfield examinations of lesion were negative. Diagnosis was changed from phimosis to paraphimosis on 28 January. A Kahn blood test during the period of hospitalization was 4-plus and the diagnosis was changed to syphilis on 29 January. Four mapharsen injections were given at the hospital and a notation made in his record to continue antiluetic therapy for 18 months. The penile lesion had subsided by 2 March, and as the patient did not desire a circumcision he was discharged to duty on 13 March. Therapy continued aboard ship as follows: From 8 February to 18 April ten 0.06-gram injections of mapharsen and one 0.13-gram injection of bismuth; from 25 April to 28 June ten 0.13-gram injections of bismuth and one 0.06-gram injection of mapharsen; from 5 July to 19 August seven 0.06-gram injections of mapharsen. The patient developed a severe nitritoid reaction 1 to 2 minutes following an injection of mapharsen on 3 August. Similar reactions occurred following the sixth and seventh injections given on 11 and 19 August in spite of premedication and precautions. Laboratory findings were negative. Adrenalin was given for the reaction and the patient was admitted to the sick bay and given 2,400,000 units of penicillin.

Recovery from reactions in 1 to 2 hours. Discharged to duty on 13 September.

Case 16-1945.—This patient was exposed to infection on 13 March 1945 and a diagnosis of syphilis was made on the clinical appearance of a penile lesion and two 4-plus Kahn blood tests. A 0.04-gram injection of mapharsen was given on 16 May followed by 0.06-gram injections on 19, 22, and 25 May and 0.4-gram injections on 29 May and 15 June. Bismuth in 1-cc. injections was given on 18, 22, and 29 May. The reaction occurred about 4 hours after each of the last four mapharsen injections manifested by tingling and tightness of skin with a sense of feverishness and slight nausea and anorexia, but no vomiting. When the size of the dose of mapharsen was reduced to 0.04 gram, a rise in temperature and a generalized mild edema and hyperesthesia of the arms were also noted. All treatment was stopped for 2 weeks. A 0.04-gram injection of mapharsen on 15 June and a 0.25-gram injection of neoarsphenamine on 26 June produced similar reactions. White blood count, total protein, and hemoglobin were all within normal limits. The treatment for each reaction consisted of bed rest for 24 hours, 1,000 cc. to 1,500 cc. of 5-percent dextrose solution given intravenously, codeine and aspirin plus sedation with nembutal. After the first reaction, 0.5 cc. of epinephrine was also given.

Recovery time 24 hours.

Case 17-1945.—After exposure to infection on 4 May 1945, this patient reported to the sick bay on 8 June with a well developed chancre on the penis. A darkfield examination was positive for *Treponema pallidum*. No blood serum was done. A 0.03-gram injection of mapharsen was given on 8 June, followed by a 0.045-gram injection on 10 June, and 0.06-gram injections on 12, 14, 16, and 19 June. About 4 hours after the last injection, the patient had a chill which was followed by a temperature rise to 105.6° F., mental confusion, and bloody diarrhea. 20 June—white blood count: 13,650; urinalysis: color, amber; reaction, 5.5; specific gravity, 1.020; albumin, weak positive; sugar, negative; casts, many granular with occasional hyaline; mucus, large amount; leukocytes, 20-30; erythrocytes, 4-5; epithelium, 1-3. 21 June—Urinalysis: color, amber; transparency, clear; reaction, 6.5; specific gravity, 1.015; albumin, negative; sugar, negative; mucus, large amount; leukocytes, 6-8; erythrocytes, 2-3; epithelium, 1-4; 23 June—Urinalysis: color, amber; transparency, cloudy; reaction, 7.5; specific gravity, 1.025; albumin, negative; sugar, negative; mucus, large amount; leukocytes, loaded; erythrocytes, 4-6; epithelium, 8-10.

Treatment for reaction: At 1130 on 19 June, 1,000 cc. of 5 percent dextrose in saline solution intravenously and an alcohol sponge bath; "APC" 10 grains and sodium bicarbonate 10 grains orally at 1600 and every 4 hours thereafter through 0600, 23 June; and at 0800 on 20 June, 1,000 cc. of 5 percent dextrose in saline solution intravenously.

Recovery complete in 4 days, and penicillin therapy was started.

Case 18-1945.—Exposure to infection occurred on 1 May 1944, and the patient developed a primary sore on the penis on 20 May. A darkfield examination on 29 May was positive for *Treponema pallidum*. On the shaft of the penis and on the edematous foreskin there were 3 similar ulcers which had clean bases and elevated indurated margins. Hard, rubbery, enlarged lymph nodes were present in both inguinal regions. A Kahn blood test was 2 plus on 1 June and negative on 1 July 1945. The first course of mapharsen, consisting of 9 injections, a total of 0.54 gram, was given between 29 May and 21 June 1944; the second course, consisting of 16 injections, a total of 0.96 gram, was given between 28 September

and 22 November 1944; the third course, consisting of 10 injections, a total of 0.6 gram, was given between 5 December 1944 and 2 February 1945; the fourth course consisting of 10 injections, a total of 0.6 gram, was given between 5 May and 11 July 1945; and the fifth course, consisting of 9 injections, a total of 1.08 grams, was given between 4 September and 14 November 1945.

Two minutes after the 0.6 gram mapharsen injection on 14 November 1945 the patient was admitted to the sick bay at 1030, with flushed face, tingling of the fingers, and a bitter taste in his mouth. No previous reactions had occurred. He vomited once, bringing up clear fluid. Examination revealed: blood pressure, 120/70; pulse 80; respirations, 20; no respiratory or circulatory embarrassment; a flushed face; heart and lungs, normal. At 1130 he developed a mild supraorbital edema and vomited the sodium sulfate that had been given. Blood pressure 118/70, pulse 76, full and regular, and slight nausea were noted at 1300. The following treatment was administered on the day of the reaction: 1030: $\frac{1}{2}$ cc. of adrenalin and atropine, $\frac{1}{100}$ grain, intramuscularly; sodium formaldehyde sulfoxylate, 5 grams, intravenously and orally; and 1,000 cc. of physiologic saline solution intravenously; 1130: 1 cc. of adrenalin in peanut oil and 60 grains of sodium sulfate orally; 1230: 1,000 cc. of 5-percent dextrose solution intravenously, 30 grains of sodium bicarbonate, 5 grams of sodium formaldehyde sulfoxylate, and 1 ounce of aluminum hydroxide gel orally; 1600: 1,000 cc. of Ringer's solution, 30 grains of sodium bicarbonate, and 1 ounce of aluminum hydroxide gel orally; 2000: 1,000 cc. of 5 percent dextrose in saline solution intravenously, 30 grains of sodium bicarbonate, and 1 ounce of aluminum hydroxide gel orally. Patient had a good night. The two loose stools during the night were not grossly blood. On the day following the reaction blood pressure was 124/76, periorbital edema and flushing had subsided, and there was no nausea, abdominal cramps, or respiratory or cardiac symptoms. Thirty grains of sodium bicarbonate and 1 ounce of aluminum hydroxide gel orally were given at 0730 on 15 November. No further medications were necessary.

Laboratory findings: 14 November: red blood count, 4,440,000; hemoglobin, 90 percent; white blood count, 12,500 with 72 percent segmented cells, 25 lymphocytes, 2 eosinophiles, and 1 basophile; urine: acid and straw colored; specific gravity, 1.023; albumin, negative; sugar, 2 plus; microscopic, negative. 15 November: red blood count, 4,350,000; hemoglobin, 90 percent; white blood count, 7,050 with 81 segmented cells, 15 lymphocytes, 3 eosinophiles and 1 basophile; urine: amber colored; acid; specific gravity, 1.022; albumin, negative; sugar, 1 plus. 16 November: red blood count, 4,700,000; hemoglobin, 88 percent; white blood count, 7,450 with 61 segmented cells, 36 lymphocytes, 2 monocytes and 1 eosinophile.

The patient was clinically well on 16 November and was discharged to duty without sequelae on 19 November. Recovery time 5 days.

Case 19-1945.—This patient was exposed to infection on 19 May 1945, and developed an open lesion on the underside of the frenum. On 1 June a darkfield examination was positive for *Treponema pallidum*. A 0.04-gram injection of mapharsen was given on 4 June and 5 hours later the patient developed a mild itching of the skin, dyspnea, headache, and a temperature of 101° F. No laboratory work was done. Treatment consisted of bed rest, 10 cc. of a 10-percent solution of calcium gluconate intravenously, and $\frac{1}{4}$ grain of morphine sulfate.

Recovery complete in 16 days.

Case 20-1945.—This patient was exposed to infection on 25 April 1945 and developed an ulcer on the penis 3 weeks later. Darkfield examinations were

negative and the ulcer healed after 5 weeks of local applications. A generalized maculo-papular rash appeared about 2 months after exposure. Physical examination revealed lymphadenopathy, a generalized rash, and indurated areas in the coronal sulcus of penis at the sites of the previous ulcers. There were no mucous patches. Kahn blood tests were reported as positive on 27 June and 2 July. The patient was placed on the routine 26-week schedule and treated as follows:

2 July: Mapharsen 0.03 gram intravenously and bismuth subsalicylate 2 cc. intramuscularly.

5 July: Mapharsen 0.06 gram intravenously.

9 July: Mapharsen 0.06 gram intravenously and bismuth subsalicylate 2 cc. intramuscularly.

12 July: No treatment.

16 July: Mapharsen 0.06 gram intravenously and bismuth subsalicylate 2 cc. intramuscularly.

19 July: No treatment.

23 July: Bismuth subsalicylate 2 cc. intramuscularly.

30 July: Mapharsen 0.03 gram and bismuth subsalicylate 2 cc.

A reaction occurred about 4 hours after each mapharsen injection and consisted of headache, vomiting, chills, and a fever of 102°–104° F., in that order. Fever, anorexia, malaise, and pains in the joints and lymph nodes lasted for a week following the injection on 9 July. Treatment with bismuth subsalicylate was continuous, but mapharsen was omitted on 2 occasions. It was established that the reaction was not due to bismuth. Blood counts and urinalyses were negative except on 9 July when there was a white blood count of 14,100. It was thought that the reactions were probably due to "therapeutic shock" and would disappear in time. However, there was no change in the reaction, and the patient's clinical condition was much worse than indicated by laboratory test. Consequently, penicillin therapy was instituted on 31 July and 40,000 units were given every 3 hours for 10 doses. Within 24 hours there was marked improvement, and in 3 days the patient was feeling normal, and had a voracious appetite. No other specific treatment was given. The reaction had been treated symptomatically with analgesics and fluids. Patient was discharged to duty on 8 August 1945.

NOTE: The same lot of mapharsen had been used in the treatment of otherluetics without any untoward reactions.

ARSENICAL NEURITIS

Case 21-1945.—This patient was exposed to infection in April or May 1944. A darkfield examination and Kahn blood test in July were reported as negative. A diagnosis of syphilis was established by positive darkfield examinations on 28 and 29 August 1944, and a positive Kahn blood test on 28 August. Five injections of mapharsen, a total of 0.28 gram, were given at a naval training school and the standard 26-week course of treatment was continued aboard ship. A 0.03-gram injection of mapharsen was given on 1 January 1945, followed by eleven 0.06-gram injections from 5 January through 9 February. A 0.13-gram injection of bismuth was given on 5 January followed by five 0.26-gram injections from 8 January through 5 February. Symptoms developed gradually during the sixth week of treatment and was not attributed to any one dose. The patient developed pains in both shoulders, which limited his activity, and he showed little early response to symptomatic and physical therapy. The symptoms grad-

ually improved and disappeared. However, about 1 month after onset and about 2 weeks prior to disappearance of symptoms, the patient complained of vague numbness and paresthesias on the medial side of his right forearm and hand. There were variable and equivocal signs of hyperesthesia over the area of distribution of the ulnar nerve, but no muscle weakness or generalized neuritis were present.

Symptomatic treatment and vitamin B preparations were administered and the paresthesias gradually disappeared, leaving the volar surfaces of the palm and the fourth and fifth fingers last. As there had been no evidence of metallic poisoning, treatment had been continuous. The patient remained symptom-free for the last 4 weeks. Kahn blood reactions were doubtful on 26 January, 2-plus on 30 January, and negative on 20 February and 20 April 1945.

GASTRO-INTESTINAL REACTION

Case 22—1945.—The history of exposure to infection in this case is unknown. On 30 July 1945 the patient was placed on a 26-week schedule of mapharsen and bismuth treatment for syphilis. The third arsenical injection was followed by mild nausea and vomiting. Subsequent injections of mapharsen resulted in increasingly severe nausea, vomiting, and diarrhea, the symptoms occurring about 2 hours after treatment. Arsenical treatment was discontinued on 21 September 1945, when a particularly prostrating episode of vomiting and diarrhea occurred after the sixteenth mapharsen injection. Total dosage of mapharsen, 0.96 gram, and of bismuth, 1.30 grams. No fever or dermatitis were noted at any time. Treatment with penicillin instituted. Recovery time was not reported.

COMMENT: It is believed that the reaction was due to excretion of arsenic into the gastro-intestinal tract.

VASOMOTOR PHENOMENA

Case 23—1945.—This patient was exposed to infection on 20 August 1941. An ulceration on frenum of the penis appeared on 6 September 1941. Five days later darkfield examinations were positive for *Treponema pallidum*. Treatment consisted of 33 mapharsen injections, a total of 1.98 grams, and 35 bismuth injections, a total of 4.55 grams, between 11 September 1941 and 15 January 1943. In July 1943, three Kahn blood tests were positive and treatment was resumed on 10 July. Eighteen mapharsen injections, a total of 1.08 grams, and 16 bismuth injections, a total of 2.08 grams, were given between July 1943 and June 1944. On 5 April 1944 a Kahn blood reaction was positive and on 18 June spinal fluid examination and a Kahn blood reaction were negative. Blood Kahns in August and October 1944 were reported as positive and the patient was transferred to the sick list on board a hospital ship. Secondary lesions were present at this time. The 26-week plan of treatment was instituted. Sixteen 0.06-gram injections of mapharsen and five 0.03-gram injections of bismuth were given from 31 March to 21 May 1945. The reaction occurred 1 hour and 15 minutes following the last injection given at 2145 on 21 May 1945. At 2300, the patient had a chill, sharp fever, equally dilated pupils, blood pressure 155/95, pulse 108, and rigor for 20 minutes; at 2330, temperature 101° F., pulse 96, blood pressure 142/84; at 2345, blood pressure 130/74, and temperature 102° F. Patient was considered out of danger. At 2400, blood pressure 134/78 and temperature 101° F. No blood examinations were made during the time of

reaction. Subsequent examination showed a red blood count of 4,600,000, white blood count of 3,500, and hemoglobin, 12.5 grams.

Treatment for the reaction was symptomatic. Recovery was complete at 0300, 22 May. Recovery time 5 hours.

Case 24-1945.—The history of exposure to infection in this case is unknown. The man reported for duty and completion of syphilitic treatment. After receiving a total of 1.38 grams of mapharsen and 1.95 grams of bismuth subsalicylate the patient experienced what appeared to be a mild vasomotor reaction. This episode was marked by dizziness, dyspnea, paresthesia of arms and legs, and a sense of tightness in abdomen. Examination revealed anxious facies, free perspiration, and a weak pulse. The patient was given a sedative and 1,000 cc. of 5 percent dextrose in saline solution intravenously. Twelve hours later he was transferred to a naval hospital.

Recovery time and further treatment were not reported.

Case 25-1945.—This patient was exposed to infection on 14 October 1944, and 3 days later a typical chancre appeared on the penis. A darkfield examination showed *Treponema pallidum* on the same day. Blood Kahn was never positive. Treatment with mapharsen started on 17 October 1944 and injections were continued until 26 January 1945, a total of twenty 0.06-gram injections being given. Mapharsen treatment was resumed on 25 March and sixteen 0.06-gram injections were given between this date and 28 May. Four courses of bismuth subsalicylate in oil were given; the first course, 5 injections, between 20 October and 22 November 1944; the second course, 3 injections, between 13 December and 27 December 1944; the third course, 6 injections, between 29 January 1945 and 1 March; and the fourth course, started on 13 May, was still in progress on 28 May. All bismuth injections were 0.5 gram. To date of reaction the patient received 2.16 grams of mapharsen and 8.5 grams of bismuth subsalicylate.

The reaction occurred about 45 minutes after the mapharsen injection on 28 May. The patient suddenly became nauseated and weak, and experienced vertigo, vomiting, sudden diarrhea, shortness of breath, and paresthesias of both feet and legs with a transient inability to move legs. The latter symptom was thought to be of hysterical origin. Physical examination revealed a rapid pulse, normal blood pressure, and a slightly elevated temperature. Patient was apprehensive and sweating profusely, but of good color. Chest was clear except for slight expiratory wheezes. Neurological examination was negative. He experienced a shaking chill, which was of several minutes' duration. The vomiting and retching continued for about 2 hours, and the retro-sternal tightness and hyperventilation continued for about 1 hour. The blood count and urine examinations were normal. The urine contained no hemoglobin on the day of or the day after the reaction.

Treatment for the reaction consisted of intravenous infusion of 1,000 cc. of dextrose in saline solution, administered immediately; 50 milligrams of ephedrine sulfate, administered subcutaneously; and 3 grains of sodium amytal orally when the vomiting had ceased.

Except for a feeling of weakness, recovery was complete in 12 hours.

BLOOD DYSCRASIAS

Case 26-1945.—The history of exposure in this case is unknown. The patient had completed the first 20 weeks of a "26-week course" of antiluetic therapy at

a naval station. Mapharsen in 0.06-gram injections had been given biweekly and bismuth injections had been given weekly. The course of antiluetic therapy was continued aboard ship, twelve 0.06-gram injections of mapharsen being given between 1 January and 9 February and bismuth in oil, five 0.26-gram injections, from 8 January to 5 February 1945.

The patient complained slightly of vertigo following the injections given on 5 and 8 January 1945. He experienced no sudden or definite onset of symptoms, but complained of generalized weakness, weight loss over a period of months, as well as an intermittent pain in the left ankle. No specific dose of antiluetic therapy can be credited with having caused the reaction since the patient presented no abnormal objective findings until 10 days after the last treatment, when a blood count revealed a leukopenia. The blood picture was as follows:

Date	WBC	Lymphocytes	Segmented cells	Mono-cytes	Band forms	Eosinophiles
		<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
February 19.....	2,300	46	42	6		
February 20.....	2,600	44	45	9	2	
February 21 (a. m.).....	2,600	29	67	2	2	
February 21 (p. m.).....	3,500	21	67	7	3	2

Hemoglobin determinations stayed at 90 percent and red blood counts ranged between 4,450,000 and 4,900,000.

Although the patient did not appear acutely ill at any time and showed no other evidence of blood dyscrasias, it was thought that the depression of the bone marrow might have been caused by antiluetic therapy and he was accordingly transferred to a naval hospital. Recovery time was not reported.

COMMENT: In view of the development aboard this vessel of one case of infectious mononucleosis (diagnosis established at a naval hospital) and the demonstration of a leukopenia (one below 3,000 white blood count) in several other members of the crew, with equivocal symptoms and no history of antiluetic therapy it is now felt that this patient's peculiar blood picture was the result of an infectious disease—possibly infectious mononucleosis rather than that of bismuth and mapharsen therapy.

Case 27-1945.—Following exposure to infection on 16 May 1945, this patient was admitted to the sick list with gonococcus infection, urethra, approximately 5 days after exposure. He was treated effectively with 100,000 units of penicillin. Ulcers about the size of a dime with raised, slightly irregular borders surrounded by a faint area of erythema appeared on shaft of penis about 3 weeks after exposure. Local inguinal adenopathy was also present. Darkfields were negative on 12, 18, 19 and 30 June 1945. Kahn blood tests were negative on 13, 30 June and 4 July; 4-plus on 6 July; and 3-plus on 25 July. A 0.04-gram injection of mapharsen was given on 6 July followed by 0.06-gram injections on 8, 10, 13, 17, 20, 25 and 27 July, a total of 0.46 gram. Bismuth subsalicylate in oil was given in 0.2-gram injections on 6, 10, 17 and 25 July, a total of 0.8 gram. Two days after receiving his seventh mapharsen and fourth bismuth injection, the patient noticed the onset of general malaise and aching of the lower back. The eighth mapharsen injection was given the following morning and 2 hours later he was admitted to the sick bay. Physical examination on 27 July revealed: Tempera-

ture, 100.8° F., pulse, 80; blood pressure, 108/20; flushed face; moderately injected throat; heart and lungs negative; urinalysis normal. Patient appears acutely ill.

The blood picture was as follows:

Date	RBC	WBC	Lym- pho- cytes	Mono- cytes	Baso- philes	Seg- mented cells	Juve- niles	Eosino- philes	Band forms
July 27, 1945.....	4,500,000	7,850	175	22	3				
July 28, 1945.....		7,850	86	12	1		1		
July 29, 1945.....		7,450	79	8	2	6	1	4	
July 30, 1945.....		6,900	76	1		17	1		5
July 31, 1945.....		10,750	45	3	2	47		3	
August 1, 1945.....		9,750	40	1	1	57		1	

¹ 8 large immature lymphocytes containing vacuoles were found.

The patient appeared clinically well and his throat was normal in appearance on 30, 31 July and 1 August 1945. It was thought that the mapharsen or bismuth might have caused the agranulocytic blood picture and it was decided to give him a full course of penicillin treatment. Course of 60 doses of 40,000 units each was begun on 2 August. Recovery time was not reported.

NOTE: Three other men were under treatment with the same lot of mapharsen and experienced no reactions.

LIVER DAMAGE

Case 28-1945.—This patient was exposed to infection on 26 September 1944, and on 1 November he developed a chancre near the frenulum. Darkfield examination was positive on 7 November. From 5 November 1944 to 18 January 1945, he received nineteen 0.06-gram injections of mapharsen and five 0.26-gram injections of bismuth subsalicylate.

The reaction occurred about 5 minutes after the last mapharsen injection. The first manifestations were a burning sensation of the eyes and mouth, followed by nausea, vomiting, and diarrhea. The burning sensation subsided 3 hours after the administration of 0.5 cc. of epinephrine subcutaneously; the diarrhea subsided in 24 hours, but the nausea and vomiting persisted for 48 hours. In 36 hours the patient developed an icteric tint to sclerae. Jaundice gradually increased for the next 8 days and then gradually subsided. There was slight tenderness in the right upper quadrant during the first 4 days, but at no time was there any definite change in the size of the liver. A low-grade fever as high as 99.4° F. was run for 8 days.

Laboratory findings: 19 January 1945: Red blood count 5,300,000; white blood count, 7,400, 62 segmented cells, 35 lymphocytes, 1 band form, 1 juvenile, and 1 monocyte, urine was negative, but became positive for bile on the third day and remained positive until 27 January. On 1 February: Red blood count, 5,100,000, hemoglobin 90; white blood count, 6,200, 62 segmented cells, 36 lymphocytes, and 2 monocytes. Urine negative.

Treatment for reaction: One-half cc. of epinephrine was administered immediately following the first burning sensation; patient admitted to the sick bay on 22 January and placed on a fat-free, high carbohydrate, moderate protein and high vitamin diet with added vitamins; 1,000 cc. of 5 percent dextrose in

saline solution was administered daily for 3 days. Following this treatment he was able to take large amounts of sweetened fluids by mouth.

Discharge to duty on the fourteenth day, icterus-free and asymptomatic. An antiluetic course of penicillin was contemplated.

LIVER DAMAGE (DOUBTFUL REACTION)

Case 29-1945.—This patient was exposed to infection on 15 July 1945. One week later darkfield examination of the initial lesion showed *Treponema pallidum*. Treatment with mapharsen was instituted with a 0.03-gram injection on 25 July, followed by a 0.045-gram injection on 26 July, and 0.06-gram injections on 27, 28, 30 July and 1 August 1945. Bismuth in 0.20 gram injections was given on 26, 28, 30 July and 1 August. The first symptoms of the reaction occurred approximately 24 hours after the last mapharsen injection. The clinical manifestations on 2 August were headache, nausea, vomiting, general malaise, temperature 100° F., and pulse 88. There was no evidence of jaundice, liver enlargement, or other positive physical findings. On 6 August the general symptoms had largely disappeared, but the sclerae showed a definite jaundice. The liver, however, was not enlarged.

Laboratory findings: 3 August: Icterus index, 9 units; urine, repeatedly positive for bile, otherwise negative. 13 August: White blood count, 9,200; hemoglobin, 100 percent.

Treatment for reaction was bed rest and increased fluids. Kahn blood test was negative on 25 August and the jaundice had disappeared. Treatment with penicillin was started on 29 August.

Recovery time, 23 days.

FATAL REACTION

Case 30-1945.—This patient acquired a primary lesion of syphilis in October 1944. A darkfield examination of the primary lesion was positive for *Treponema pallidum* in October 1944 and routine antiluetic treatment was started on 10 October. On 30 November the patient was admitted to the sick list with gonococcus infection, urethra.

Antiluetic treatment consisted of 10 injections of mapharsen 10 October to 31 October 1944, a total of 0.57 gram; 8 injections of mapharsen 7 November 1944 to 2 January 1945, a total of 0.48 gram; 6 injections of mapharsen 20 February to 23 March 1945, a total of 0.36 gram, 11 injections of bismuth 22 October to 7 November 1944, a total of 1.43 grams, 3 injections of bismuth 9 January to 23 January 1945, a total of 0.39 gram, and 4 injections of bismuth 20 February to 23 March 1945, a total of 0.54 gram. On 27 April 1945, the patient was transferred to a hospital ship with a diagnosis of balanoposthitis and on 4 May he was further transferred to a naval hospital. No reactions occurred during these courses. Health record notations indicated that the primary ulcerations were treated locally with calomel and healed in a week.

Aboard the hospital ship the balanoposthitis was treated with saline soaks and boric acid powder. It was noted at that time that the patient had developed a nausea and anorexia. No Kahn test was recorded and the health record stated "antiluetic therapy has been inadequate, although it is possible that the original diagnosis of syphilis based on a single darkfield examination might be in error." However, spinal fluid examination at the hospital showed a negative Kahn, no

increase in globulin, and a colloidal gold curve 3322110000. Marked hepatic dysfunction was evident on admission to the hospital. The patient failed rapidly in spite of protein and carbohydrate therapy. The icterus index was 90 units, tryosine and leucine crystals appeared in the urine. He died after a 2-day coma.

Autopsy findings: Icterus, epicardial and visceral pleural hemorrhages, acute yellow atrophy of the liver, ascites and bilateral hydrothorax, anemic and icteric brain, and pulmonary congestion.

COMMENT: It was assumed that the liver atrophy was due to the arsenical therapy, although the reaction was considerably delayed and is unusual with mapharsen. However, a test for arsenic was positive in the post-mortem bladder urine. No data were available at the hospital concerning the identification of the drugs used, the technique, preparation, or injection.

REACTIONS OF MINOR IMPORTANCE

Case 32-1945.—The history of exposure in this case is unknown. The patient developed a lesion beneath the tongue and neither the date of initial lesion nor a history of any darkfield examination was recorded. Kahn blood reactions were 4-plus on 8 and 18 August 1944. History showed the lesion healed on 14 August 1944. Five 1 cc.-injections of bismuth had been given before a diagnosis of syphilis was established. Treatment consisted of twenty 0.06-gram injections of mapharsen given between 16 August and 9 October; three 1 cc.-injections of bismuth between 21 August and 1 September 1944; and six 1 cc.-injections between 18 December 1944 and 15 January 1945. After transfer to this activity 1 cc.-injections of bismuth subsalicylate were given on 5 and 12 February and 0.06-gram mapharsen injections were given on 2, 9, and 16 February 1945.

About 6 hours after the last injection the patient felt weak, nauseated, and vomited several times. He was put to bed and solid food withheld until the following day. Fruit juices and other sugary fluids were given.

Laboratory findings: Urine, negative except for a trace of bile; white blood count, 4,350; red blood count, 6,420,000; hemoglobin, 96 percent; and Kahn, negative.

Reaction was considered very slight and recovery was complete in 5 days.

Case 33-1945.—The history of exposure in this case is unknown. A diagnosis of syphilis was made by positive Kahn blood tests. The patient received twenty-one 0.06-gram injections of mapharsen between 9 June and 20 October 1944; four 0.06-gram injections of mapharsen between 25 January and 15 February 1945; nine 0.13-gram injections of bismuth subsalicylate between 16 November 1944 and 18 January 1945; and fourteen 0.13-gram injections of bismuth subsalicylate between 22 February and 25 May 1945. The reaction occurred 3 hours after a 0.06-gram mapharsen injection on 30 April 1945. Symptoms were headache, weakness, nausea, and a temperature of 102.6° F. No laboratory work was done. Treatment for the reaction, bed rest, two A. P. C. tablets every 3 hours, a liquid diet, and forced fluids.

Recovery in 36 hours.

Case 34-1945.—This patient was exposed to infection in the early part of June 1945, and a diagnosis of syphilis was made on chancre-like sore on the penis and a 4-plus Kahn blood test. Treatment with mapharsen started with a 0.03-gram injection on 7 July 1945 followed by a 0.045-gram injection on 9 July, six 0.06-gram injections from 12 July to 23 July, and 0.03-gram injections on 26 and 30 July. Bismuth in 0.19-gram injections was given on 12, 23, and 30 July. Reaction manifestations were nausea, vomiting, extremely sore gums, and diarrhea, and

occurred about 3 hours after the 0.06-gram mapharsen injections. Laboratory findings were negative, although a Kahn blood test was again 4-plus. Treatment was given with 2,400,000 units of penicillin administered in 60 injections over a 7½-day period. Penicillin therapy was completed on 24 August 1945 at which time a Kahn blood test was negative.

Recovery time was not reported.

Case 35-1945.—Following exposure to infection on 24 December 1944, this patient developed 2 punched-out penile ulcers. Ulcers had clean bases, indurated walls and exuded a serous discharge. A darkfield examination on 24 January 1945 was positive for *Treponema pallidum* and a Kahn blood test on the same day was negative. Twenty injections of mapharsen, a total of 1.14 grams, were given from 25 January to 8 April 1945 and 5 injections of bismuth, a total of 1.0 gram, from 8 March to 8 April 1945. The reaction occurred 7 days after the 12 April mapharsen injection. Physical examination showed the sclerae to be definitely yellow; other findings were negative. The blood icterus index on 17 April was No. 21. Treatment consisted of bed rest, increased sugar consumption, and discontinuance of mapharsen.

Recovery complete in 12 days.

Case 36-1945.—This patient was admitted on 6 March 1945 with multiple, punched-out 8-day-old ulcers on shaft of penis and general glandular enlargement. Darkfield examinations were positive for *Treponema pallidum* and treatment was instituted with a 0.03-gram mapharsen injection. Thirty minutes later the patient experienced a chill and a temperature of 104° F. Temperature returned to normal within 12 hours and there were no apparent complications of renal or hepatic origin. Mapharsen in 0.06-gram injections was resumed 3 days later without ill effects, and the patient has continued on the standard 26-week course of treatment.

Recovery was complete in 12 hours.

Case 37-1945.—This patient was exposed to infection on 17 February 1945. A "red spot" was noticed by him at the site of chancre 1 week prior to admission. Upon admission to the sick list a moist, typical chancre was present on the left antero-lateral surface of the penis at the junction of the foreskin and penis. Moderate non-tender lymphadenopathy, more marked on the left, was present. Darkfield examinations of the penile lesion were positive for *Treponema pallidum* on 19 and 20 March. Kahn blood tests were negative on 21 March and 2 April. Treatment was started on 20 March with a 0.03-gram injection of mapharsen and a 0.1-gram injection of bismuth subsalicylate, followed by 0.06-gram mapharsen injections on 23, 27, and 30 March and a 0.2-gram bismuth injection on 27 March. Two hours after the mapharsen injection on 30 March the patient complained of malaise, left groin pain, and chilly sensations. Shortly thereafter he complained of nausea and had some retching. Temperature ranged from 101°–104° F. for 48 hours after which there was a spontaneous return of temperature to normal. All symptoms, including the painful, enlarged inguinal glands, disappeared within 6 hours after onset. On 31 March laboratory examination revealed white blood count, 9,050 differential count, normal; red blood count, 4,900,000; hemoglobin, 96 (Sahli); urine, normal.

Treatment was entirely symptomatic. No drugs were used except aspirin as an antipyretic.

Recovery complete in 48 hours.

NOTE: Twelve injections in other patients had preceded this case and were without incident.

Case 38-1945.—After exposure to infection on 24 February 1945, this patient developed a small penile lesion on 5 March 1945. Darkfield examination on 8 March was positive for *Treponema pallidum*. Treatment was started on 8 March with a 0.04-gram injection of mapharsen, followed by 0.06-gram injections on 11 and 13 March and a 0.04-gram injection on 17 March. The reactions occurred approximately 20 hours after the 0.06-gram injections and 6 to 8 hours after the 0.04-gram injection. On 12 May temperature was 100° F. at 1200, normal at 2000 and on 14 May, 101.2° F. at 1200 and 103.4° F. at 1600. Six to eight hours following the 0.04-gram injection of mapharsen on 17 March temperature rose to 104° F. Treatment for the reactions which occurred on 14 and 17 March consisted of forced fluids; aspirin, grains 10; codeine, grain ½; and alcohol sponging for 3 hours. Laboratory findings: Blood Kahn, white blood count, and urine examinations, negative.

Recovery was complete in 1 day.

Case 39-1945.—This patient was exposed to infection on 14 February 1945 and on 26 February he developed bilateral inguinal lymphadenopathy and a rosette type chancre on the prepuce. A darkfield examination on 26 February was positive for *Treponema pallidum* and a Kahn blood test on the same day was negative. From 8 March to 22 March 1945, 0.06 gram of mapharsen was given, followed by another 0.06-gram injection on 25 March. Ten days later the patient complained of a generalized body itch. Physical examination was negative and urinalysis was normal. Treatment consisted of bed rest, increased sugar consumption, discontinuance of mapharsen, and symptomatic treatment.

A second reaction occurred on 23 May 1945, although no antiluetic treatment had been administered since the first reaction.

The patient recovered from the first reaction on 24 April and from the second reaction on 8 June 1945, 20 and 15 days respectively.

Case 40-1945.—The patient was exposed to infection on 14 July 1944, and syphilis was diagnosed on 17 July by positive darkfield examination on the primary penile lesion. Mapharsen treatment from 24 July 1944 to 14 February 1945 consisted of 2.08 grams of mapharsen in 35 injections and 2.7 grams of bismuth in 14 injections. The reaction occurred 7 hours after the 0.06-gram injection of mapharsen on 14 February. The patient was admitted to the sick list with a diagnosis of poisoning, therapeutic, syphilis (mapharsen). Temperature of 100.8° F. was the only physical finding. Laboratory examinations were negative. Treatment for the reaction consisted of aspirin, grains 10, for headache.

Recovery was complete in 1 day.

Case 41-1945.—This patient was exposed to infection on 12 June 1945. The initial lesion appeared on the shaft of penis beneath the foreskin on 6 July. Bilateral inguinal adenopathy was also present at this time. A darkfield examination was positive for *Treponema pallidum* on 10 July and a Kahn blood test on the same day was negative. The patient received 0.06-gram mapharsen injections on 6, 9, 13, 16, 19, and 30 July. Two hours after the injection of mapharsen on 30 July the patient developed pain, stiffness and tenderness of the joints, temperature 102° F., a stiff neck, severe conjunctival injection, and generalized body aching. Laboratory examination revealed a white blood count of 15,400 and a negative urinalysis. Treatment for the reaction was symptomatic and recovery was complete in 24 hours.

Case 42-1945.—This patient was exposed to infection on 3 October 1945. A diagnosis of syphilis was made by a 3-plus Kahn blood test on 1 November. Repeat Kahn and Wassermann blood tests were 3-plus and 4-plus respectively. Smears taken from the vulva lesions on 1 November were negative. Antiluetic

treatment started on 6 November, consisting of 2,400,000 units of penicillin, 9 injections of mapharsen, a total of 4.86 grams, and 5 injections of bismuth a total of 3.25 grams.

The patient was admitted on 29 November with a diagnosis of cellulitis (chemical, right cubital fossa) which was the result of improper administration of mapharsen. Reaction and pain subsided rapidly and the patient was discharged to duty on 4 December 1945.

Treatment for the reaction or facts concerning the arsenical causing the reaction was not reported.

NEOARSPHENAMINE

FATAL REACTION

Case 31-1945.—When examined on 3 January 1945, this patient (a supernumerary) was found to be 3 months pregnant. A blood specimen submitted for routine Kahn test was reported as positive. An injection of mapharsen was given on 13 February and treatment continued with neoarsphenamine because the dispensary stock of mapharsen was depleted. Seven 0.6-gram injections of neoarsphenamine were given between 16 February and 13 March. Arsenicals were discontinued on 16 March and treatment with 0.5 cc injections of bismuth subsalicylate, intramuscularly, instituted. The patient reported for routine treatment on 20 March and it was observed that she had developed an exfoliative dermatitis covering the body. All antiluetic treatment was discontinued and the patient was transferred to the dispensary for observation.

The patient died on 25 March; cause of death, poisoning, therapeutic, acute (neoarsphenamine).

A post-mortem examination revealed a toxic necrosis of liver, spleen, and kidneys, and an arsenical dermatitis.



INFLUENZA VACCINATION: COMPARISON OF INTRACUTANEOUS AND SUBCUTANEOUS METHODS

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The value of inactivated influenza virus vaccine has been demonstrated convincingly. The combined type A and type B influenza vaccine, prepared from chick embryo allantoic fluid, concentrated and eluted from embryonic red blood cells, given in a single dose of 1 cc. subcutaneously, was shown to have a striking protective effect in the epidemic of type A influenza in November and December 1943 (1). The same vaccine proved to have an equally striking protective effect

in an outbreak of type B influenza in December 1945 (2). In addition to field studies, the Red Blood Cell Agglutination-Inhibition Test of Hirst (3) has been used by most investigators as an index of the serum antibody response to immunization. The evidence correlating the serum antibody level as determined by the Hirst test, and immunity to influenza will be discussed later; it will suffice to comment here that in the immunization studies noted in this paragraph, this vaccine produced a highly satisfactory antibody response to both the A and B virus components.

It has been known for a long time that a small intracutaneous inoculation will often yield an immune response similar to that produced by a much larger subcutaneous dose (4). Intracutaneous immunization with minute doses of immunizing agents have produced highly satisfactory immune responses with typhoid vaccine (5), diphtheria toxoid (6), and scarlet fever toxin (7). Because of the expense and difficulty of obtaining large amounts of inactivated influenza virus vaccine, the experiment reported here was undertaken to test the efficacy of intracutaneous influenza vaccination compared with subcutaneous vaccination.

DESCRIPTION OF THE EXPERIMENT

A total of 1,953 men attached to the U. S. Naval Training and Distribution Center, Treasure Island, Calif., took part in this study. They were divided into 4 groups, as follows:

Group A.—Received 1 dose of 0.1 cc. influenza vaccine intracutaneously.

Group B.—Received 2 doses of 0.1 cc. influenza vaccine intracutaneously, at an interval of 2 weeks.

Group C.—Received 1 dose of 1.0 cc. influenza vaccine subcutaneously.

Group D.—Received 1 dose of 0.1 cc. control material.

The vaccine was prepared, as described, by E. R. Squibb and Sons, New York, and preserved with 1:40,000 merthiolate. The control material consisted of 1:40,000 merthiolate. The method of handling the men was as follows: The men entered a room in single file (fig. 1). At the first table they were assigned a group letter and a serial number, which was used throughout the study in identifying blood specimens. At the vaccination table, one man gave all inoculations. At the bleeding tables, 10-cc. samples of venous blood were collected aseptically on the first 746 men who came through the line. The remaining men were merely vaccinated. To obtain clinical data, a form (fig. 2) was inserted into each man's health record, to be used in the event of an

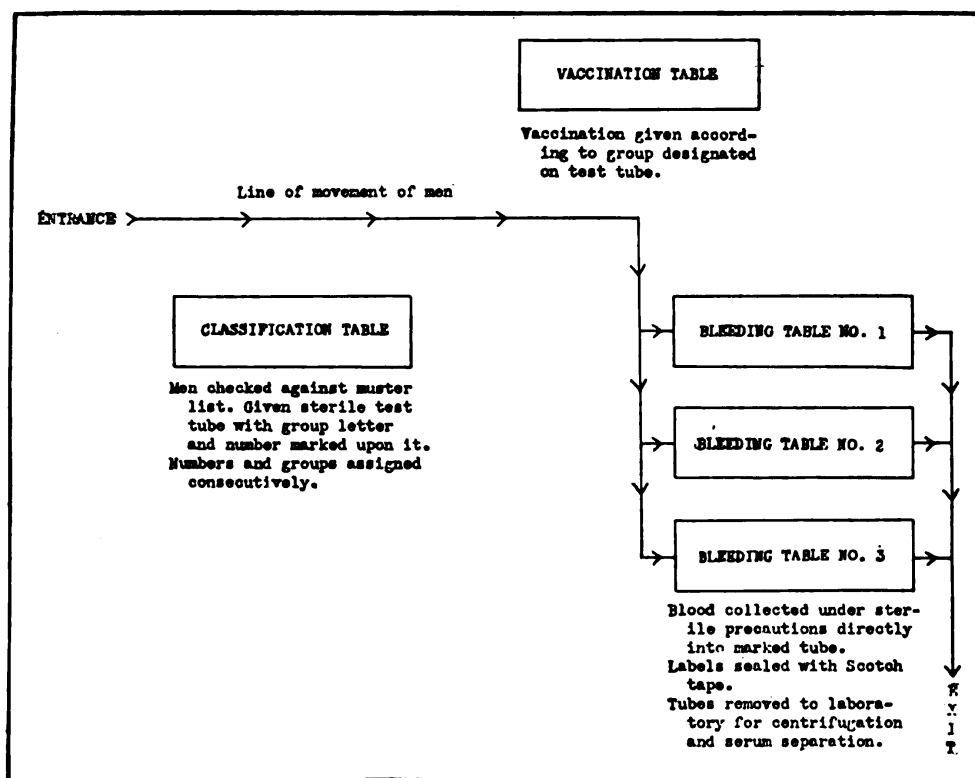


FIGURE 1.—Floor plan for vaccination and bleeding procedure.

influenza infection. On the day following the vaccination, 1,416 men were examined to determine the incidence of reactions. The local reaction was measured, and the men were questioned about the occurrence of systemic reactions of fever, chills, headache, or sore arm. Two weeks after the first vaccination, second blood specimens were obtained on the serological study group and at the same time all of the men in Group B received their second inoculation. Two weeks later third blood specimens were obtained on the men in serological study group. A total of 1,883 blood specimens was drawn for serological study (table 1). The clotted blood specimens were centrifuged, and the sera decanted into sterile tubes. These were stored at 5° C., for from 4 to 10 weeks, until the tests were completed.

Because of its simplicity, the modification of the Hirst Red Blood Cell Agglutination-Inhibition Test, proposed by Naval Medical Research Unit No. 1, was adopted (8). In this modification, human type O red blood cells, rather than chicken red blood cells, are used, and a constant dilution of serum (1:100) is titrated against varying dilutions of virus. The details of the test are as given next.

TABLE 1.—*Group distribution in influenza vaccination study*

Group	Mode of administration	Dosage	Total number of men	Serological study group
A.....	Vaccine intracutaneously.....	1 dose, 0.1 cc.....	472	163
B.....	do.....	2 doses, 0.1 cc., 2 weeks' interval	500	218
C.....	Vaccine subcutaneously.....	1 dose, 1.0 cc.....	501	187
D.....	Control material intracutaneously.....	1 dose.....	472	178
Total.....	1,945	746

INFLUENZA RECORD SHEET	
<p>If this man <u>develops Influenza (816)</u> or is detached, fill out this sheet and return to Epidemiology Unit No. 82, U. S. Naval Hospital, Treasure Island, Calif.</p>	
Name.....	
Rate..... Service Number.....	
Date of onset.....	
No. of days on sick list due to Influenza.....	
Symptoms attributable to Influenza:	
Chills.....	Cough.....
Aching.....	Coryza.....
Headache.....	Asthenia.....
Sore throat.....	Other.....
Complications attributable to Influenza:	
None.....	Pneumonia.....
Sinusitis.....	Bronchitis.....
Otitis media.....	Other.....

FIGURE 2.—Influenza record form inserted into health records for clinical following up of influenza vaccination.

TECHNIQUE OF THE RED BLOOD CELL AGGLUTINATION TEST¹

1. *Preparation of the red blood suspension.*—Ten centimeters of type O blood are obtained by venipuncture and mixed in a small flask with 0.4 cc. of 10-percent sodium citrate solution to prevent clotting. One to two cc. are removed for each series of titrations, and the remainder stored in the refrigerator labeled with the name of the donor and

¹ All titrations were done by Chief Pharmacist's Mate N. E. Dufresne, U. S. N.

the date of bleeding. Blood is not kept longer than 5 days. The blood removed for the titration is washed twice in saline solution, then transferred to a graduated centrifuge tube, and centrifuged for 20 minutes at approximately 150 revolutions per minute. The packed cells are then diluted in saline solution to make a 0.75-percent suspension, which is kept in the refrigerator until ready for use.

2. *Titration of human blood.*—Sera are inactivated at 56° C. for 30 minutes. To make 1:100 serum dilution 0.2 cc. of serum are mixed with 19.8 cc. saline solution. To each tube of a series of 10 chemically clean serological tubes, 0.5 cc. of the 1:100 serum dilution is added. An A virus or a B virus of strong agglutinating power (1:280 or higher) is used. The virus strains used in the titrations were: Type A, PR8 strain, and type B, Lee strain. These were kindly supplied by Naval Medical Research Unit No. 1. Dilutions of the virus are made in saline solution from 1:5 through 1:2560 in twofold steps. The virus dilutions are added in 0.5 cc. amounts to the tubes containing the serum. To control tube is added 0.5 cc. of saline. A virus titration is done with each run. This procedure follows the same plan as the human test serum samples, except that a 1.0 percent gelatin solution is used instead of normal rabbit serum (9). After the addition of the virus the tubes are shaken well and allowed to stand for 20 minutes at room temperature. Then 0.1 cc. of the 0.75 percent red blood cell suspension is added to each tube. The tubes are again shaken thoroughly and allowed to stand at room temperature for 1 to 2 hours. The tubes are then reshaken and placed in the refrigerator for a night. Readings of + + + +, + + +, + +, + and negative are based on the pattern of the settled cells in the bottoms of the tubes. The last one plus reading is considered the end point of agglutination.

Titers are determined by the difference in end point between the test serum titration and the virus titration. For example, if A virus agglutinates to an end point of 1:1280 in the virus titration, and a test serum has an end point of 1:40 in the serum titration, the titer is 1,280 divided by 40, or 32. This indicates that the 1:100 dilution of immune serum inhibited 32 times as much virus as a comparable dilution of nonimmune serum (or gelatin solution).

RESULTS

a. *Reaction to vaccination.*—The reactions to the vaccination were classified according to the extent of the local redness and swelling and the occurrence of such systemic symptoms as headache, chills, fever, or sore arm. The percentage distribution of the local and systemic reactions to the influenza inoculations are presented in table 2.

b. Antibody response to vaccination.—The results of the Hirst Red Blood Cell Agglutination-Inhibition Titrations are summarized in a series of tables. Table 3 shows the distribution of serum antibody titers against the type A influenza virus. Table 4 shows the distribution of serum antibody titers against type B influenza virus. Table 5 shows the mean rises in serum antibody titers against both viruses. From the results of these titrations it appears that following a single intracutaneous injection of inactivated influenza virus vaccine, a rise in serum antibody titer occurs which is considerably greater than that following either 2 intracutaneous injections, or a single subcutaneous injection. This occurred against both the A virus and the B virus.

TABLE 2.—Percentage distribution of local and systemic reactions to the influenza inoculations ^{a b}

Group	Number examined	Local reactions				Systemic reactions
		None	Mild (1-4 cm ²)	Moderate (4-25 cm ²)	Severe (more than 25 cm ²)	
A and B (0.1 cc. i. d.)	718	Percent 12.6	Percent 63.7	Percent 23.2	Percent 0.5	Percent 3.2
C (1.0 cc. s. c.)	356	62.7	7	19.6	10.7	9.6
D (Control)	342	93.9	5.2	.9	0	3.2

^a In addition to the reactions listed 2 men in group A and 1 man in group C developed transient arthralgia, fever, and elevated sedimentation rates.

^b The meaning of the symbol cm² is square centimeters, of the symbol i. d. is intradermally, and of the symbol s. c. is subcutaneously.

TABLE 3.—Distribution of serum antibody titers against type A influenza virus following influenza vaccination ¹

Serum antibody titer	Group A (0.1 cc. i. d.)			Group B (0.1 cc. i. d. 2X)			Group C (1.0 cc. s. c.)			Group D (Control)	
	Initial	2 weeks	4 weeks	Initial	2 weeks	4 weeks	Initial	2 weeks	4 weeks	Initial	2 weeks
2	0	0	0	0	0	0	1	0	0	0	0
4	4	0	0	6	0	0	6	0	0	6	7
8	28	2	0	44	0	0	51	2	0	39	54
16	58	2	0	58	0	0	59	28	1	56	57
32	41	6	0	69	7	1	43	80	16	56	38
64	28	37	0	36	81	1	26	50	50	21	19
128	3	53	7	4	81	46	0	23	40	0	0
256	1	48	26	1	42	102	1	0	5	0	0
512	0	6	22	0	0	40	0	1	2	0	0
640	0	0	35	0	0	2	0	0	0	0	0
1,024	0	1	0	0	1	0	0	0	0	0	0
1,280	0	0	14	0	0	1	0	0	0	0	0
Total	163	155	104	218	212	193	187	184	114	178	175
Mean titer	30.1	172	568	31.0	123	285	24.9	52.5	98	24.5	26.3

¹ The meaning of the symbol i. d. is intradermally, of the symbol i. d. 2X is 2 doses intradermally, and of the symbol s. c. is subcutaneously.

TABLE 4.—*Distribution of serum antibody titers against type B influenza virus following influenza vaccination*¹

Serum antibody titer	Group A (0.1 cc. i. d.)			Group B (0.1 cc. i. d. 2X)			Group C (1.0 cc. s. c.)			Group D (Control)	
	Initial	2 weeks	4 weeks	Initial	2 weeks	4 weeks	Initial	2 weeks	4 weeks	Initial	2 weeks
4.....	0	0	0	0	0	0	0	0	0	0	0
8.....	4	0	0	0	0	0	9	0	0	14	15
16.....	6	0	0	30	0	0	27	1	0	26	25
32.....	0	4	0	10	0	0	4	34	5	10	10
64.....	0	32	0	0	36	0	0	5	35	0	0
128.....	0	4	27	0	4	33	0	0	0	0	0
256.....	0	0	13	0	0	7	0	0	0	0	0
640.....	0	0	0	0	0	0	0	0	0	0	0
Total.....	40	40	40	40	40	40	40	40	40	50	50
Mean titer.....	15	67	170	20	70	150	16	36	60	17	17

¹ The meaning of the symbol i. d. is intradermally, of the symbol i. d. 2X is 2 doses intradermally, and of s. c. is subcutaneously.

TABLE 5.—*Mean rise in serum antibody titer following influenza vaccination*¹

Group	Against influenza virus "A"		Against influenza virus "B"	
	2 weeks	4 weeks	2 weeks	4 weeks
A..... (0.1 cc. i. d.)	8.3X	33.3X	4.6X	11.4X
B..... (0.1 cc. i. d. 2X)	6.7X	14.3X	3.7X	8.2X
C..... (1.0 cc. s. c.)	2.6X	7.4X	2.4X	4.6X
D..... (Control)	0.5X	-----	No change	-----

¹ The meaning of the symbol X as used in this table is number of "times" the titer rose over the initial titer.

C. Clinical data.—There were no diagnosed cases of influenza in the group during the period of this study, so the interpretation of the results must be based entirely upon the immunological response.

COMMENT

Although a direct relationship between the antibodies concerned in the Hirst Red Blood Cell Agglutination-Inhibition Test, and those which are concerned in immunity to influenza, has never been demonstrated, there is some evidence which is strongly suggestive. This may be summarized as follows:

1. There is a correlation between the red blood cell agglutination-inhibition power of immune serum (either post vaccinal, or convalescent), and the virus-neutralizing power of the same serum as tested by the mouse protection test. This was noted by

Hirst in his original article (3 (a)), and has been confirmed since (10) (11).

2. There is a correlation between the red blood cell agglutination-inhibition power of the serum and individual susceptibility to experimental influenza. Henle et al. demonstrated very clearly, in producing experimental influenza in vaccinated and unvaccinated individuals, that there was a direct relationship between the preinhalation antibody titer, and an individual susceptibility to influenza (11).

3. There is a correlation between the antibody titer of post vaccination sera, and the protection against naturally occurring influenza (1) (2).

It has been shown in this work that following a single dose of 0.1 cc. of inactivated influenza virus vaccine intracutaneously, a considerable rise in the serum antibody titer occurs rapidly, reaching a level in 1 month of several times that obtained by a single dose of 1 cc. of the same vaccine subcutaneously. The duration of this effect is not known but others have shown that the peak effect following subcutaneous administration occurs in 2 to 4 weeks (12), so that it can probably be assumed that the titers have been followed through the period of maximum levels. Whether the method of intracutaneous administration would give adequate protection against influenza can be determined only by the clinical trial. The results of this study would indicate that such a trial is highly desirable.

SUMMARY AND CONCLUSIONS

1. Serum antibody titers, using a modification of the Hirst Red Blood Cell Agglutination-Inhibition Test, have been determined on four large groups of individuals who received inactivated influenza virus vaccine either intracutaneously or subcutaneously, or control material.

2. The incidence of reactions, both local and general, was lower in the group receiving the vaccine intracutaneously.

3. The greatest rise in titer against both A and B influenza virus occurred in the group receiving a single dose of 0.1 cc. influenza virus vaccine intracutaneously.

4. The striking serological response to intracutaneous vaccination warrants further clinical trial.

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INCIDENCE OF VENEREAL DISEASE IN SEPARATEES EXAMINED AT THE U. S. NAVAL PERSONNEL SEPARA- TION CENTER, JACKSONVILLE, FLA.

LESTER D. BIBLER

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and

WILLIAM H. GOLEY

Chief Pharmacist's Mate, U. S. N.

Between 12 November 1945 and 12 March 1946 this center examined 4,646 officers and 37,457 enlisted men for separation from the service. The majority of these separated at this activity were from the States of Florida and Georgia. The State having the next largest number of separatees was Alabama.

Of those examined, 1,174 were found to have venereal disease and all of these cases may be classified as recent or new, since in every case of syphilis the primary infection (date of exposure) occurred within the past year and no case of gonorrhea was of more than 90 days' duration.

The incidence of venereal disease among the separatees as examined at this activity is shown in the following table:

Class of personnel	Number examined	Venereal disease				Total	Rate per 1,000
		Syphilis	Gonor-rhea	Lympho-granuloma	Chan-croid		
Officer	4,646	3	5	0	0	8	1.7
White enlisted	33,331	181	261*	3	6	451	13.5
Negro enlisted	4,126	342	359	8	6	715	173.3
Total	42,103	526	625	11	12	1,174	27.9

As will be seen from the table, the greatest incidence of venereal disease was among the Negro enlisted personnel, whose rate for all venereal disease was 12.8 times higher¹ than that for white enlisted personnel.

¹ This ratio differs only slightly with the average ratio, 12.8, as computed from venereal disease incidence rates for white and Negro personnel, continental naval districts, for the months November 1945 to February 1946 inclusive, as given in Statistics of Navy Medicine.—Editor.



NOTES ON CONTRIBUTORS



CONTRIBUTORS TO THE SECTION ON ADVANCES IN MEDICINE AND THE MEDICAL SCIENCES IN 1946

The editor wishes to thank the many eminent specialists who gave their time and effort to assist him with suggestions and advice on the most important advances in their fields in 1946. The names of those who made contributions follow.

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ant surgeon, USNR, 26 May 1943. Intern, Research and Educational Hospital of the University of Illinois, Chicago, Ill., 1943-44. Served with Naval V-12 Units, Dallas, Tex., Apr.-Sept., 1944; U. S. S. *Sevier*, Dec. 1944-Oct. 1945; Beach Party, Sept. 1944-Dec. 1944; and Charleston Group, Sixteenth Fleet, Oct. 1944-Sept. 1946. Released from active duty, 7 Sept. 1946. Owner and member of surgical staff, Lightner Hospital, Harrisburg, Ill., 1946-Member: Saline County Medical Society and Illinois State Medical Society.

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Ribble, George B., Captain (MC) USN (*Epidemic of Prickly Heat on Aircraft Carrier*, p. 77). M. D., University of Minnesota, 1931. Intern, U. S. Naval Hospital, Great Lakes, Ill., 3 July 1931-20 May 1933. Appointed assistant surgeon, USN, 30 June 1931. Served on U. S. S. *New Mexico*, 1935-38, U. S. S. *Quincy*, 1940-42, and U. S. S. *Lexington*, 1944-45. Member: American Medical Association, Association of Military Surgeons, and Aero-Medical Association.

Ross, Bernard, Lieutenant, junior grade (MC) USNR (Inactive) (*Intensive Autohemotherapy in the Treatment of Acne*, p. 154). B. A., New York University, 1941; M. D., Middlesex University School of Medicine, 1944. Intern, Beth Moses Hospital, Brooklyn, N. Y., Sept. 1944-Mar. 1945. Appointed assistant surgeon, USNR, 16 Apr. 1945 from New York. Served with Sixth U. S. Marine Division. Released from active duty 19 Aug. 1946. Resident, Jewish Sanitarium and Hospital for Chronic Diseases, Brooklyn, N. Y.

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Calif.; on U. S. S. *Kadashan Bay*, and with 74th Naval Construction Battalion, 2nd Naval Construction Brigade. Released from active duty 15 June 1946. Member: Illinois State Medical Society and Chicago Medical Society.

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Strauch, James H., Lieutenant (MC) USNR (Inactive) (*Treatment of Erysipeloid of Rosenbach With Penicillin*, p. 150). A. B., Ohio Wesleyan University 1939; M. D., Harvard Medical School, 1942. Assistant in pathology, Mallory Institute of Pathology, Boston City Hospital, Boston, Mass., June 1942-Jan. 1943; instructor in bacteriology, Harvard Medical School, June 1942-Jan. 1943; intern in medicine, Jan. 1943-Jan. 1944, and resident in dermatology and syphilology, Jan.-Oct. 1944, University Hospitals of Cleveland, Cleveland, O.; demonstrator in dermatology, Western Reserve University School of Medicine, Jan.-Oct. 1944. Appointed ensign, H-V (P), USNR, 28 Mar. 1942; assistant surgeon, USNR, 11 June 1942 from Massachusetts. Specialty: Dermatology and syphilology. Served at U. S. Naval Hospital, St. Albans, N. Y., Nov. 1944-Sept. 1945; Anchor Section Dispensary, Manila, P. I., Nov. 1945-Apr. 1946; served with Fleet Hospital No. 114. Released from active duty 31 July 1946. Member: Ohio State Medical Society and Cleveland Academy of Medicine. Diplomate: National Board of Medical Examiners.

Stubenbord, William D., Commander (Inactive) (MC) USNR (*Tinea Capitis*, p. 159). B. S., Wesleyan University, 1927; M. D., Cornell University Medical College, 1931. Intern, July 1931-Aug. 1932, assistant resident, Aug. 1932-Sept. 1933, and assistant attending physician, 1943, New York Hospital; associate visiting physician, 1942, Bellevue Hospital. Appointed assistant surgeon, USNR, 18 Aug. 1939 from New York. Served at U. S. Naval Hospital, New Orleans, La., U. S. Naval Military Government Hospital, Guam, and U. S. Naval Hospital, Quantico, Va. Released from active duty 14 Mar. 1946. Fellow: American College of Physicians, American Medical Association, and New York Academy of Medicine; member: New York County Medical Society. Diplomate: National Board of Medical Examiners and American Board of Internal Medicine.

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can Hospital, 1937-, Chicago, Ill., and U. S. Naval Hospital, Great Lakes, Ill., 1946-. Fellow: American College of Surgeons; member: American Diabetes Association, Central Surgical Society, Chicago Surgical Society, American Medical Association, Illinois State Medical Society, and Chicago Medical Society. Diplomate: American Board of Surgery.

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Whitehead, Hugh G., Jr. Commander (MC) USNR (Inactive) (*Pericarditis During Penicillin Treatment for Syphilis*, p. 141). M. D., University of Virginia Department of Medicine, 1932. Intern and house physician, St. Luke's Hospital, New York, N. Y., 1933-35; resident, chest division, Bellevue Hospital, New York, N. Y., 1935-36; instructor of medicine, Johns Hopkins University School of Medicine, and visiting physician, Johns Hopkins Hospital, Baltimore, Md., 1936-. Appointed assistant surgeon, USNR, 22 May 1935 from Maryland. Specialty: Internal medicine and diseases of the chest. Officer-in-charge, U. S. Naval Unit, Fitzsimons General Hospital, U. S. Army, Denver, Colo., 1941; flight surgeon, U. S. Naval Air Station, Pensacola, Fla., 1943; senior medical officer, U. S. S. *Cowpens*, 1944-45. Released from active duty 22 Jan. 1946. Fellow: American College of Physicians and American College of Chest Physicians; member: Baltimore City Medical Society.



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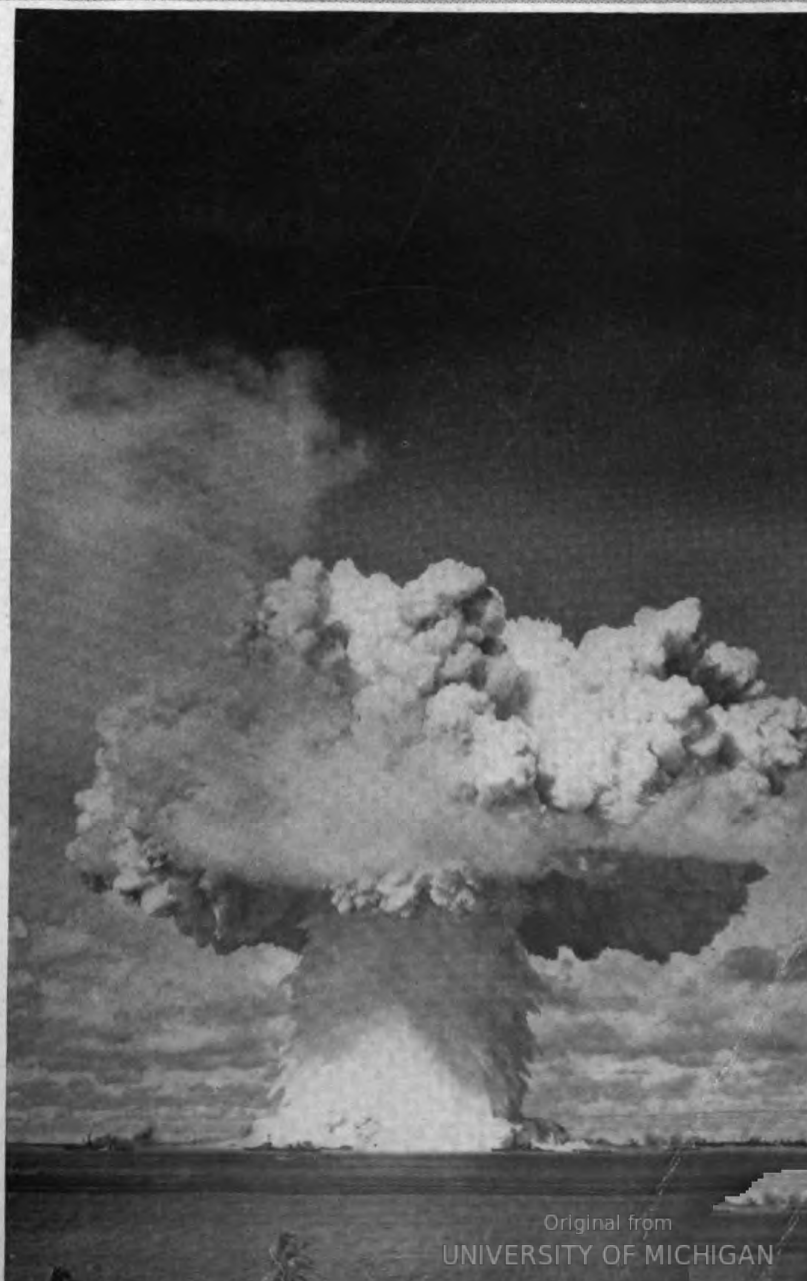


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COVER PHOTOGRAPH

BIKINI IN ACTION.—The Baker Day explosion of the fifth atomic bomb, at Bikini 24 July 1946, as recorded by an automatically operated camera on a nearby island. This picture caught the column of water at about the highest peak achieved. The leading article in this number of the **BULLETIN** deals with some of the medical aspects of the atomic bomb at Bikini and elsewhere.

—Joint Army-Navy Task Force Photo.

TABLE OF CONTENTS



	Page
PREFACE	III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Medicine at the Crossroads—R. Harold Draeger and Shields Warren	219
Acute Coronary Insufficiency; a New Concept of Acute Coronary Diseases—Arthur M. Master and Oscar Auerbach	226
Penicillin Therapy in Relapsing Fever; Report of Four Cases—John F. Shaul and T. Harry Saferstein	238
Multiple Pulmonary Calcifications—Alvin C. Wyman	244
A Technique for Root Canal Therapy and Root Resection as an Aid to the Problems of a Dental Officer Afloat—William M. Lancaster	249
Emotional Disturbances Encountered in Carrier Pilots—William H. Requarth	253
Repair of Soft Tissue Defects of the Foot—William G. Hamm and S. Baron Hardy	263
Vitamin-Deficiency Diseases in Allied Prisoners of the Japanese—John E. Nardini	272
Subnormal Intelligence in the Maladjusted Naval Trainee; Problems in Recognizing Low Intelligence—Minter M. Jackson	279
Symptoms and Management of Arterial Hypertension Among Naval Personnel—Raymond E. Smalley	287
The Treatment of Renal Colic With Special Emphasis on Crystalluria—Paul R. Stalnaker	297
Chronic Asthma; Results of Treatment in 100 Cases—Donald S. Smith ..	302
The Wartime Log of a United States Navy Hospital Ship to June 1943; Part IV—Richard A. Kern and Melville J. Aston	307

EDITORIALS

Fortieth Anniversary of the Establishment of the "United States Naval Medical Bulletin," April 1907–April 1947	323
Editors and Assistant Editors of the "United States Naval Medical Bulletin," 1907–1947	325
A New Antimalarial Drug—Paludrine	326
The Power of Punctuation	326

CLINICAL NOTES

	Page
Primary Adenocarcinoma of the Appendix With Development of Mucus Fistula—George Crile, Jr., and Clarence G. Glenn.....	328
Hemorrhagic Ulcerative Gastrojejunitis Thirty Years After Gastro-Enterostomy for Congenital Pyloric Stenosis—Thomas G. Hays and Waltman Walters.....	330
Rat-Bite Fever With Report of a Case—Frederick L. Reuter.....	333
Hyperergy to Nicotine—Harry H. Pote.....	337
Duodenal Ulcer and Hookworm Infestation: Diagnostic and Military Medico-Legal Problem—Henry A. Monat and Irving S. Cooper....	339

MEDICAL AND SURGICAL DEVICES

Use of Wangenstein Suction Aboard Ship—Carruth J. Wagner and Duwane D. Dandurant.....	343
--	-----

BOOK NOTICES

Harvey Cushing, Fullon—Their Mother's Sons, Strecker—Medical Research, edited by Smith—The Differential Diagnosis of Jaundice, Schiff—Contact Lens Technique, Beacher—Lectures on Preventive Medicine, Sutton—The Chest, Rigler—Ulcer of the Stomach, Duodenum and Jejunum, Brown; edited by Christian.....	347
--	-----

PREVENTIVE MEDICINE

Long-Term Observation of Plasmodium Vivax Malaria in the Returned Serviceman; Part I—Anthony A. Bianco, George M. Saunders, Arnold S. Levine, and Robert Cohn.....	352
Observations on the Dispersal of DDT From Aircraft for the Control of Mosquitoes—Herbert S. Hurlbut, John D. Maple, Charles S. Wilson, Stanley R. Fallander, and Chester N. Husman.....	368
NOTES ON CONTRIBUTORS.....	380



ADDRESS YOUR REPLY TO
BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT, WASHINGTON 25, D. C.
AND REFER TO No.



WASHINGTON 25, D. C.



27 Jan. 1947

Fellow Officers of the Medical Department:

One of the principal difficulties in obtaining and retaining personnel in the Medical Department is the question of housing shortages which often make it extremely difficult to find suitable places to live when ordered to a new station. As you all know, the housing shortage is not limited to the Navy, but is nation-wide, though it is apparently lessening with increased construction now in progress.

There are two important ways in which we hope the situation will improve for our personnel. One is to move people less frequently, the other to obtain additional quarters for medical personnel by new construction or conversion of existing structures.

This does not mean that we will have immediately the results we desire. It is necessary to have considerable changes of personnel, even though every effort is being made to reduce it to a minimum. The provision of additional quarters is also not the matter of a moment, and cooperative planning, including the Navy as a whole, funds, and time, are required. My purpose here is to point out that this matter of living conditions, so important to all of us, is receiving most earnest attention. Indeed definite progress in building is being made in some localities.

Sincerely,

A handwritten signature in cursive script, reading "C. J. Johnson".

Rear Admiral, Medical Corps,
Surgeon General, United States Navy.

VIII

U. S. NAVAL MEDICAL BULLETIN

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No. 2

*"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"*¹

SPECIAL ARTICLES



MEDICINE AT THE CROSSROADS²

R. HAROLD DRAEGER

Captain (MC) U. S. N.

and

SHIELDS WARREN

Captain (MC) U. S. N. R.

That biological experiments be conducted in connection with Operation Crossroads was one of the earliest recommendations made by the representative of the Chief, Bureau of Medicine and Surgery, on the Staff, Commander Joint Task Force One. Shortly after the establishment of the task force, it was announced that such tests would be conducted by the Naval Medical Research Section of Joint Task Force One under the Director of Ship Material.

The U. S. S. *Burleson*, APA-67, was assigned to the section as an animal and laboratory ship. The holds were converted into large animal quarters and troop spaces into a rat room and laboratories.

¹The policy of the U. S. Naval Medical Bulletin as printed on the cover of its first issue and maintained throughout the 40 years of its existence.

²Staff, Naval Medical Research Section, Joint Task Force One: Capt. Frederick R. Lang (MC) U. S. N., statistics; Col. Elbert DeCoursey (MC) U. S. A., pathology; Commander Richard H. Lee, H (S) U. S. N. R., radiation physics; Commander John L. Tullis (MC) U. S. N., pathology; Lt. Comdr. Eugene P. Cronkite (MC) U. S. N., hematology; Lt. Comdr. Robert E. Smith, H (S) U. S. N. R., radiobiology; Maj. Daniel H. Cahoon (MC) U. S. A., pathology; Lt. Maynard Eicher, H (S) U. S. N. R., electronics, photography; Lt. Robert J. Madden, H (S) U. S. N. R., biochemistry; Capt. Robert P. Wagers (VC) A. U. S., veterinary medicine; Lt. (jg) Carl A. Harris (MC) U. S. N. R., biochemistry; Lt. (jg) James T. Park (D) L, U. S. N. R., bacteriology; First Lt. Charles L. Boyers, Jr. (CWS) A, U. S., veterinary medicine; First Lt. Edward D. Hoffman (CWS) A. U. S., chemical warfare; First Lt. Gerald W. Beveridge (MAC) A. U. S., bacteriology; Dr. W. H. Batchelor, bacteriology; Mr. R. F. Cowling, radiation technician; Mr. J. C. Frankenfeld, entomology; Mr. R. L. Evans, radiobiology.

The staff of the section consisted of 22 scientists including Army and Navy officers as well as civilians. Its nucleus was selected from the staff of the Naval Medical Research Institute which also served as the center for planning and for the collection of material. Of the 96 enlisted men, 40 were selected for their farm experience.

Goats, pigs, and rats were chosen to determine the probable effects of the atomic bomb explosions upon personnel. These species were selected because of their ability to withstand tropical conditions and because of the similarity of certain of their reactions to radiations to those observed in man. A few guinea pigs were included for comparative purposes. Mice of strains differing in their susceptibility to cancer also were exposed. The animal colonies totaled 200 goats, 200 pigs, 5,000 rats, 120 mice, and 60 guinea pigs.

A wide range of other biologic material such as insects, bacteria, fungi, seeds, antisera, toxins, bacteriophage, vitamins, and hormones were included. In addition a wide variety of inorganic substances such as medicinal agents, soils, and selected elements were included to determine whether or not they would become dangerously radioactive.

The research activities of the section were divided into five categories: statistics, biophysics, pathology, radiobiology, and photography. Specific research projects were assigned covering the various aspects of the four types of blast injuries: air blast, water blast, solid blast, and radiation blast caused by an atomic bomb explosion.

The section selected 22 target ships for the placement of test materials as representative of type at varied distances from the center of the target. These ships lay along several radii to permit observation of wind and other effects. Locations ranging from the signal halyards to the steering engine room insured that every degree of exposure of personnel aboard ship would be represented.

Target ship officers were assigned from the staff of the section to insure accuracy and speed in the placement and recovery of test materials, each being responsible for a small number of adjacent ships. Having their own boats and crews they were able to familiarize themselves with all target locations and means of access to them.

The 2 weeks prior to Test Able were utilized to place animals and other test materials. In order to avoid discomfort to the animals they were first placed collectively on the target ships and distributed to their specific locations at the last possible moment. As a check on correct placement a photograph of each target location was made.

It was decided to use most of the experimental animals in Test Able since this test apparently would provide the widest variety of atomic bomb injuries. The uncertainty of recovery of animals after Test Baker due to probable residual radioactivity strengthened this de-

cision. The test run on Queen Day (the dress rehearsal for Test Able) impressed us with the difficulties and risk to the animals entailed should postponement of the atomic bomb explosion be enforced by bad weather. As day after unfavorable day passed the almost inevitable postponement weighed more heavily upon us. When on Able Day our loud speakers told that the atom bomb was air-borne at Kwajalein our good fortune seemed incredible.

At 0900 1 July 1946 the Test Able bomb exploded. Its blinding flash gave evidence of the intensity of the thermal radiation emitted but gave no clue to the deadly, highly penetrating gamma rays and neutrons. From the towering atomic cloud radioactive material was dispersed widely.

The harmful effects of an atomic bomb explosion are caused by the liberation of a tremendous amount of energy. The type of blast injury caused depends upon the mode of transmission of this energy. Part is transmitted through matter, causing air blast, water blast, or solid blast. Energy also is emitted over a range of the electromagnetic spectrum extending from heat waves to gamma rays causing thermal burns and radiation illness. In addition energy is liberated in the form of motion of subatomic particles such as neutrons and electrons. These, as the gamma rays, cause injury to living tissue due to ionization. Injury may also arise from inhalation or ingestion of residual radioactive materials or contact with such materials.

The limiting factor in retrieving the animals and other test material from the target ships was the danger from residual radioactivity. Fortunately this proved to be relatively slight and through the prompt and efficient monitoring work of the Radiological Safety Section we were able to reenter the lagoon, dispatch target ship officers, and recover a number of animals on the day of the explosion itself. All animals were retrieved by 3 July 1946 and all other test materials several days later.

In order to obtain the greatest amount of information from all experimental animals it was essential to have not only the generously proffered help of other sections in obtaining their physical data to be correlated with the biological findings, but also necessary to have the exact physical measurements at each animal location. To this end we placed, with the animals, instrument and chemical substances. Since there was distinct possibility of radioactive contamination of test materials and the animals themselves it was necessary to screen carefully with Geiger counters all material brought back on board the U. S. S. *Burleson*. By this method we were able to prevent contamination of our laboratory spaces with fission products or with substances made radioactive by neutrons liberated by the explosion, as well to rule out any danger to our personnel.

A large number of the animals was recovered alive from the target ships. The majority of the early deaths were due to air blast; others to radiation effects. Flash burns were not an important factor as the fur of the animal in most instances provided efficient protection and in those animals that were shaved for testing of flash burn cream the efficacy of the applied materials was such as to protect the animals.

A special study of air blast injury was made using a newly developed type of cage in which secondary blast effects could be largely



FIGURE 1.—Pig quarters, No. 1 hold, U. S. S. *Burleson*

avoided by acceleration of the cage and the animal at the same rate. The 50-percent lethal dose proved to be essentially the same as that which would have been anticipated for an explosion of 20,000 tons of TNT.

Those test animals which were exposed to appreciable amounts of radiation developed much the same classical signs and symptoms of radiation sickness as were noted in the Japanese survivors of Hiroshima and Nagasaki. The first animals to die showed atrophy of lymphoid tissue, often with ulceration of the tonsils. Later there appeared a hemorrhagic diathesis and severe enteritis, frequently so marked as to result in complete necrosis of the mucosa and submucosa.

Since experiment has shown that changes in the blood picture are the most sensitive indexes to injury by ionizing radiation detailed hematologic studies were intensively pursued. As would be expected the surviving animals showed varying degrees of leukopenia, first apparent as a lymphocytopenia and later as a neutropenia. White blood cell counts as low as 300 were encountered in some of the more seriously injured animals. As these leukocytic changes developed, anemia of a severe and practically aplastic type gradually appeared in some animals and a milder chronic type in others. One animal, for example, after a period of 4 months had a hemoglobin of only 3 grams per 100 cc. of blood. The bone marrow of those animals that died early showed no gross change; as the days passed varying degrees of disappearance of the red marrow occurred with replacement by myxomatous or fatty marrow. During the period of hemorrhagic diathesis a wide range of local manifestations became apparent. Among the commonest were hemorrhage into the gastrointestinal tract, bleeding from the nose or mouth or extensive subcutaneous ecchymoses. In the guinea pigs intramuscular hemorrhages were particularly infrequent.

After some weeks partial depilation became apparent among the more exposed animals, particularly the rats and goats.

In order to follow the detailed changes of animals receiving sublethal doses of radiation representative groups were killed at intervals to give a consecutive picture of the time relationships. Microscopic studies of material obtained from the autopsies are in progress.

Treatment was carried out on a limited number of animals. Since no specific therapy is known, supportive treatment was employed in the form of multiple blood transfusions to replace the depleted cellular elements and penicillin to counteract the susceptibility to infection. The lives of a few animals have thus been prolonged while their mates receiving equal exposure are long dead.

Highly important, of course, was accurate identification of the animals and test materials and the exact locations in which they were placed. The simple forms developed by the Statistical Section of the Bureau of Medicine and Surgery made it possible to control effectively the placing and recovery of test material.

In connection with the flash burn studies, the type of protection that might be provided by different types of cloth used in uniforms was obviously of major importance. In order to avoid the exposing of animals for the purpose of evaluating this effect, fir plywood was used to back up the cloth samples since this had approximately the same heat dispersivity as human skin. The cloth swatches clearly established the superiority of white or light-colored material already indicated by the studies in Japan.

Work on other types of biological materials is actively being carried on by collaborating groups in the U. S. Department of Agriculture, the Chemical Corps and Biological Warfare Service, U. S. Army, and several universities.

By 20 July the study of test materials from Test Able became overshadowed by preparation for Test Baker. As previously stated



FIGURE 2.—Rat room, U. S. S. *Burlson*.

most of the animals were used in Test Able. We desired also to hold the number of animals to a minimum as it was uncertain how much time might elapse before they could be taken off of the target ships due to the heavy residual radioactivity anticipated after Test Baker. Twenty pigs and 200 rats were distributed on 4 representative target ships.

The Test Baker bomb exploded at 0835 25 July 1946. A tremendous mass of water rose from the lagoon and spread as a towering mush-

room bearing radioactive fission products over the target array. These deadly products rained down upon the target ships rendering many of them dangerously radioactive.

The residual radiation proved to be as great a hindrance to the recovery of animals as had been anticipated and it was 5 days before all of them could be collected. These animals received much heavier doses of radiation than animals in comparable positions in Test Able. They were exposed not only to the initial radiation, but also to prolonged radiation due to the contamination of decks and exposed bulk-head surfaces with the torrents of sea water containing induced radioactivity and fission products, in which the vessels had been drenched subsequent to the explosion.

The U. S. S. *Burleson* as refitted proved highly satisfactory for the housing and study of the animals under tropical conditions. The comfort of the animals and the cleanliness of their quarters was a source of continued favorable comment. Transportation of the large number of animals from Bikini to Washington would have been impractical by any other means than the U. S. S. *Burleson*, the adequate laboratory facilities of which permitted the vitally important studies to be made without interruption.

On arrival of the ship at Washington, the animals were transferred to the Naval Medical Research Institute at Bethesda, Md., where the facilities are unsurpassed, both for research and for the care of animals. Here the medical research initiated at Bikini has been set up as a continuing project which envisages study of the medical aspects of all phases of the development and utilization of atomic energy.

The surviving animals of Tests Able and Baker, their less fortunate mates, and the wealth of test material brought back from Bikini will provide a source of valuable data for future study in this important field of medical responsibility.

CONCLUSIONS

1. Radiation constitutes one of the most serious hazards to personnel exposed to an atomic bomb explosion.

2. The pattern of radiation injury observed in the Bikini animals produced by the release of nuclear energy in the detonation of the bomb is essentially the same as that observed in the Japanese at Hiroshima and Nagasaki.

3. The Test Baker detonation produced a serious contamination of the waters of the lagoon and of the target vessels due to the dispersion of radioactive materials resulting from the explosion of the bomb.

ACUTE CORONARY INSUFFICIENCY

A New Concept of Acute Coronary Diseases ¹

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and
OSCAR AUERBACH
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Heart diseases are by far the most frequent causes of death. It is little appreciated, however, that coronary artery disease alone, with the possible exception of cancer, is responsible for more fatalities than any other disease. Yearly, 115,000 persons succumb to them (1) (2).

A recent analysis (3) of more than 2,000 "sudden and expected natural deaths" in the Borough of Manhattan, New York, in which necropsies were performed by medical examiners, disclosed that coronary artery diseases accounted for 30 percent of all the fatalities and fully two-thirds of the cardiac deaths. Many writers (4) (5) (6) (7) have reported that coronary disease comprises from 25 to 40 percent of all heart diseases. Recently it has been revealed that not only is it the leader among heart diseases but the figures attained were the usual ones of 40 to 50 percent (8). If but one type of acute coronary artery disease is discussed, namely acute coronary artery occlusion, we find that over half a million attacks occur yearly (9). This is an average of 1 attack annually per 50 males and 1 per 180 females, over 40 years of age.

The appreciation of the importance and prevalence of coronary artery disease is necessary, but the next advance is the realization that there are really several acute coronary artery diseases rather than just one. There are two main divisions, namely: (1) acute coronary artery insufficiency and (2) acute coronary artery occlusion. In the former group belongs the short simple attack of angina pectoris and the more severe form in which myocardial necrosis takes place. In this report special emphasis will be laid on acute coronary insufficiency since this is not well understood and its frequency and importance cannot be overrated.

Slowly, beginning with the German investigators (10) (11) (12) (13) and then followed by American physicians (14) (15) (16) (17) there has been a realization that this form of acute coronary disease is common, and possesses its own pathological and electrocardio-

graphic design. My colleagues and myself emphasized the specific etiological factors, in addition to the characteristic pathological and electrocardiographic pattern (16) (18) (19). The diagnosis can and should be made on clinical and electrocardiographic grounds (1) (19). However, it is now clear that there is a definite therapy, preventative and curative. Treatment may be lifesaving. Acute coronary insufficiency is therefore now a complete entity, a distinct disease (20) (21) (22) (23), easily differentiated from acute coronary artery occlusion.

The underlying pathology of acute coronary insufficiency is, of course, generally coronary sclerosis. The patient characteristically presents an anginal syndrome and in a severe or prolonged attack, usually precipitated by exertion or excitement, acute myocardial necrosis ensues. The areas involved in the heart are often microscopic, diffuse, and are located in the subendocardial regions and in the papillary muscles. The endocardium itself and the pericardium are intact. The necrosis then is not usually the large confluent infarct extending from endocardium through pericardium as seen following acute coronary artery occlusion. The electrocardiogram has a characteristic picture probably because of the subendocardial location of the myocardial necrosis. RS-T depressions and T-wave inversions are observed. Treatment is helpful and depends on the cause.

In the illustrative case to be reported, the attack was brought on by grief over the death of a father. The electrocardiogram, taken a few hours before death, revealed deep RS-T depressions in leads I, II, and IV, with semi-inversions of the T-waves. Because of the etiology of an emotional factor and because of the typical electrocardiogram, a diagnosis of acute coronary insufficiency without acute coronary occlusion was made. It was predicted that myomalacia limited to the subendocardium would be found at autopsy and furthermore that the coronary arteries, although severely sclerotic, would be patent. (In other words, no acute coronary occlusion would be present.)

CASE 1

R. J. R., a 37-year-old white man was admitted on 29 September 1944 to the U. S. Naval Hospital, St. Albans, N. Y., with the tentative diagnosis of coronary arteriosclerosis and arteriosclerotic heart disease. At the time of his admission to the hospital, the patient complained of precordial pain with numbness down the inside of both upper extremities extending to the little fingers of both hands.

The patient's father had suffered with heart trouble, apparently coronary disease, for he developed pain in the chest after exertion. The grandparents had died of hypertensive heart disease. The past history of the patient was noncontributory until 3 years before admission. While working in a shipyard, he was told that he had high-blood pressure. Again, on his first examination for enlistment, he was rejected because of hypertension, but was accepted 1 month

later, 15 May 1943, with a blood pressure reading of 150/90. On 20 May 1944, while he was in England, he noticed shortness of breath and precordial pain after he had walked one block. The pain did not radiate and was brought on by exertion and relieved by rest. He spent 3 days in the sick bay while in London. During the return journey home from England, the symptoms continued intermittently. Eating or slight exertion resulted in precordial pain and shortness of breath.

On admission to the hospital the patient appeared well-nourished and did not look acutely ill. The heart was not enlarged by percussion. A regular sinus rhythm was present and the rate was about 78 beats per minute. The sounds were of good quality and no murmurs were heard. The aortic second sound was not loud. The blood pressure was 124/94. The urine, the blood chemistry values, and the blood count were normal. No sedimentation rate test was made. The first electrocardiogram, 2 October 1944 (fig. 1), revealed a

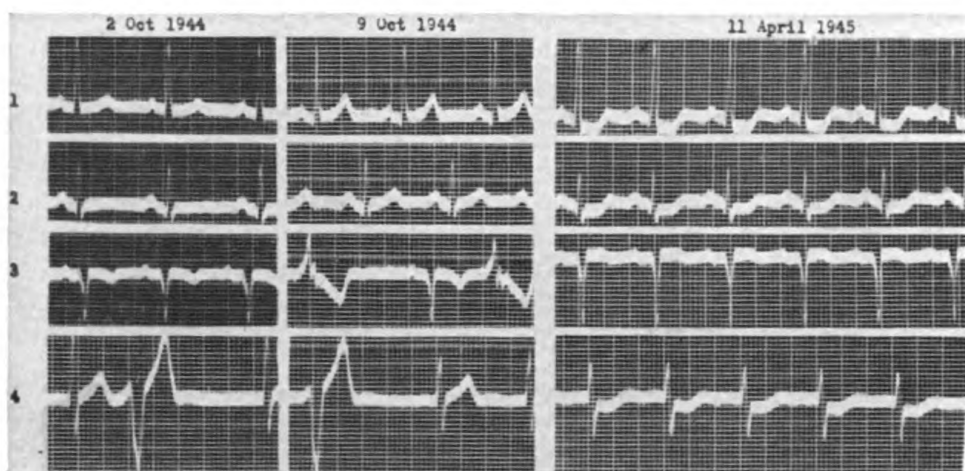


FIGURE 1.—The electrocardiogram of 2 October 1944 revealed a regular sinus rhythm, rate 82 beats per minute, a left axis deviation, occasional ventricular beats, an iso-electric (flat) T-2, and an inverted T-3. On 9 October 1944 the T-2 had returned to normal, but the T-3 inversion and the premature beats were still present. This essentially normal record remained unchanged in numerous tracings until 11 April 1945 when severe chest pain occurred followed by collapse. This electrocardiogram disclosed RS-T depressions in leads I, II, and IV, with semi-inversion of the T-waves, no elevation, no Q-waves.

regular sinus rhythm, rate of 82 beats per minute, a left axis deviation, occasional premature ventricular beats, and an iso-electric or flat T-2 and inverted T-3, which were interpreted as indicating myocardial involvement and therefore confirming the diagnosis of coronary disease. In the second tracing, 9 October 1944, the T-2 had returned to normal but the T-3 inversion and the premature beats remained. The negative QRS deflection in the third lead was an S-wave but occasionally suggested a Q-wave. However, there was no longer any definite evidence of myocardial involvement and the electrocardiogram in this normal form persisted for months until 11 April 1945, when the final illness occurred.

During the stay in the hospital, the patient continued to have precordial pain following exertion, but the pain also occurred during the night. The man, however, improved slowly and then for 1 week he was actually free of attacks.

On 22 February 1945 he departed on an emergency leave after receiving word that his father had died of acute coronary occlusion. From that moment on he developed almost continual precordial pain, accompanied by shortness of breath. On his return to the hospital on 9 March 1945, his blood pressure was 160/90. On 11 April 1945, the patient became acutely ill; he suffered from crushing substernal pain which radiated to the left shoulder and down the arm. A moderate cyanosis of the face and nail beds appeared. A gallop rhythm was audible at the apex. The blood pressure was not obtainable in either arm. The bases of the lungs were congested. The patient was placed in an oxygen tent. It was obvious that he had experienced serious myocardial involvement, and the electrocardiogram taken 11 April 1945 (fig. 1) confirmed this. A regular sinus rhythm, rate of 95 beats per minute, and a left axis deviation of the QRS were present. There were quite deep depressions of the RS-T segments in leads I, II, and IV, with semi-inverted T-waves. Because there were no RS-T elevations, no Q-waves, and no reciprocal relationship between the electrocardiographic waves in leads I and III, acute coronary artery occlusion was excluded. The next morning the patient was moribund, ashy gray in color, orthopneic, with Cheyne-Stokes respirations, and a rapid weak pulse. Pulmonary edema developed and the patient died in the early morning, 12 April 1945. As mentioned before, because of the emotional factor in the onset of the attack and because of the typical electrocardiogram, it was predicted that the subendocardium would be the seat of severe myocardial necrosis, but that no acute coronary

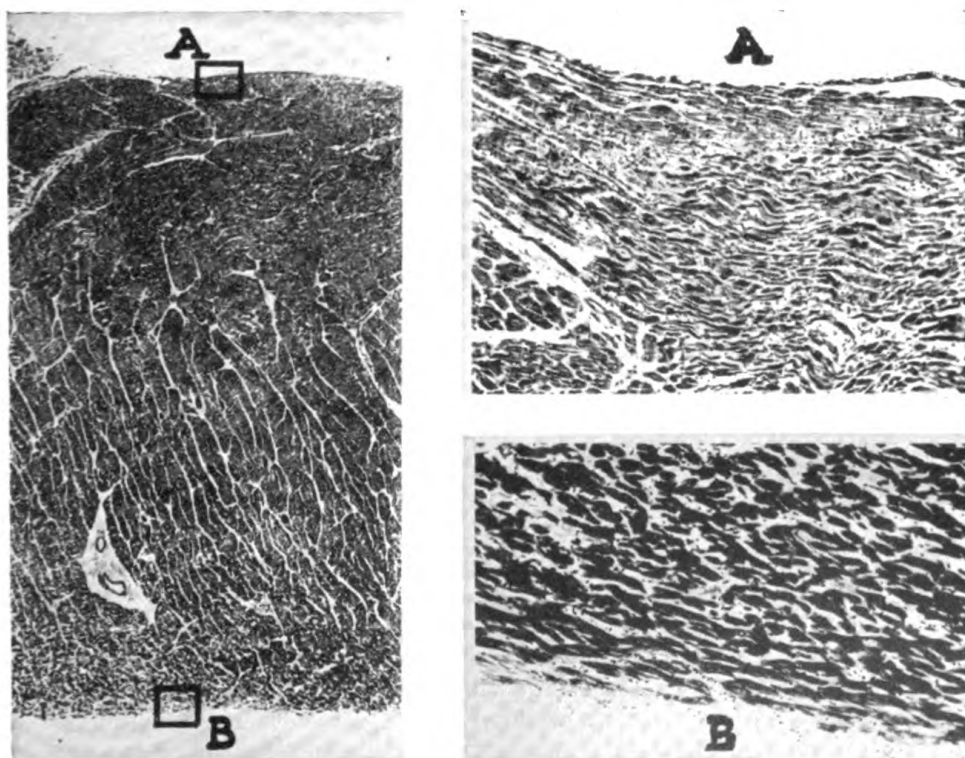


FIGURE 2.—Photomicrograph of section through left ventricular wall from endocardium (A) through to pericardium (B). Magnified insert (A) shows intact endocardium, beneath which is an area of subendocardial necrosis, infiltrated by polymorphonuclear leukocytes. No pericardial involvement and outer layers of myocardium beneath it perfectly normal.

artery occlusion would be discovered. In other words, the endocardium and pericardium would be intact and the coronary vessels, though narrowed and severely sclerotic, would be patent.

Autopsy.—The body was that of a well-developed white man who weighed 190 pounds and measured 69 inches. The face and nail beds were cyanotic.

The lungs were much heavier than normal, weighing 1,775 grams. Edema, congestion, and patches of broncho-pneumonia were present in all lobes. Microscopically many "heart failure" cells were present in the alveolar spaces.

The heart was moderately increased in size, weighing 485 grams. The pericardium was smooth and glistening and the pericardial cavity contained 15 cc. of clear fluid. The greater portion of the myocardium of the left ventricle and the interventricular septum was friable and had an opaque yellow-brown appearance. This area extended to but did not involve the endocardium. A narrow zone of intact muscle separated the infarct from the overlying pericardium. Microscopically, the endocardium, the pericardium, and the muscle beneath the pericardium were found to be intact (fig. 2). The remaining muscle disclosed



FIGURE 3.—Photograph of the right coronary artery: thickened, sclerotic wall with plaques; lumen is patent though very narrowed (hemorrhage into plaque).

many areas of early necrosis. The interstitial tissue contained collections of polymorphonuclear leukocytes and mononuclear cells. Focal areas of connective tissue, indicating old healed lesions, were also present in the wall of the left ventricle.

An advanced arteriosclerosis of both coronary arteries was present. The lumen of the circumflex branch of the left coronary artery in its proximal 3 centimeters was narrowed to a thin slit. The opening of the descending branch of the left coronary artery 1 centimeter from its origin was similarly decreased in diameter. Finally, the right coronary (fig. 3) was likewise involved, but to a lesser extent than the left. Careful coronal sections of the coronary arteries throughout their entire course, made every 2 mm. or less revealed no thrombi or any type of complete obstruction. The microscopic appearance of the vessels was also simply that of great narrowing of the lumen by arteriosclerosis of the intima. The larger portion of the plaques was composed of dense connective tissue. Cholesterol clefts and calcium deposits were seen in some of the sections.

The aorta showed an extensive arteriosclerosis in the thoracic and abdominal portions. The liver, which weighed 2,100 grams, revealed passive congestion and fatty change. The remaining viscera showed passive congestion.

DISCUSSION

A 37-year-old white man, whose grandparents died of hypertensive heart disease, was admitted for an anginal syndrome. His symptoms improved but he received a complete set-back and experienced continuous precordial pain after learning of his father's death from acute coronary thrombosis. He then developed a severe heart attack, from which he died within 24 hours. Because of the association between this severe attack and the father's death and because the electrocardiogram recorded several hours before exitus disclosed classical changes of acute coronary insufficiency without acute occlusion, this diagnosis was made before death. On postmortem examination, necrosis of the myocardium of the left ventricle and interventricular septum was found, but it did not involve endocardium or pericardium. The coronary arteries revealed advanced arteriosclerosis, but the lumens were patent.

In contradistinction to this illustrative case of acute coronary insufficiency there will be reviewed very briefly the histories of two patients who died of acute coronary occlusion. The hearts were examined at autopsy.

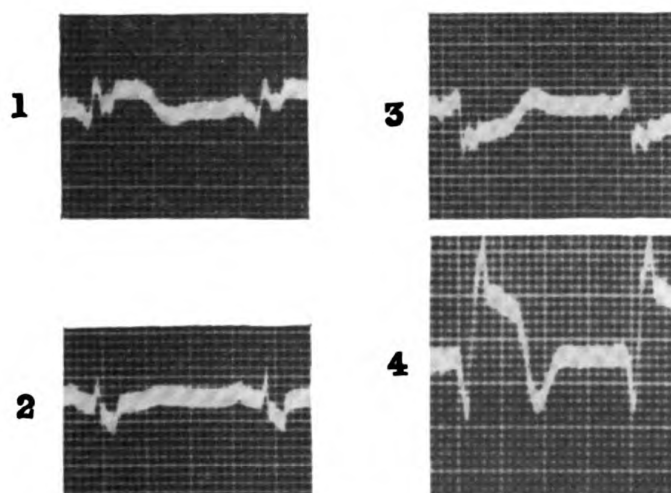


FIGURE 4.—Male, 66 years, attack of acute coronary artery occlusion, 2 January 1935. The electrocardiogram was taken on that day and death occurred also on the same date. Tracing characteristic for an anterior wall infarction, that is, relatively large Q-1 and Q-4 with RS-T elevations in these leads. At post-mortem examination there was found an acute occlusion in the left anterior descending branch of the left coronary artery and acute infarction of the anterior wall of the left ventricle.

CASE 2

M. L., m. 66. A man with long standing severe hypertension (234/134) suffered from substernal pain for 2 months and because of the progressive nature of this complaint and dyspnea his physical activities had become almost entirely limited. On 17 December 1934 he was found to be in congestive heart failure with a large tender liver and edema of the feet. On 2 January 1935, while in bed, he developed an attack of severe sternal pain. He presented an ashy gray facies, he was dyspneic, rales were heard in the lungs, and muffled, embryocarditic heart sounds with a "gallop" quality were present. A few hours later there was a leukocytosis of nearly 15,700 white blood cells. The blood pressure fell to 140/100, then to 130/100. Shock became severe, the extremities were cold and cyanotic and the patient died within 24 hours. An electrocardiogram (fig. 4) was specific for an anterior wall infarction due to acute coronary artery occlusion, that is, relatively large Q-1 and Q-4 with RS-T elevations in these leads and a mirrorlike reciprocal correspondence between leads 1 and 3. At postmortem examination there was found an acute occlusion in the anterior descending branch of the left coronary artery with acute infarction of the anterior wall of the left ventricle, extending entirely through the wall from endocardium to pericardium. On the former surface at the apex a mural thrombosis was discovered and over the outer surface an area of acute pericarditis (inflammation).

CASE 3

A. L., m., 63 years of age. This man recounted a history of sternal pain for 7 weeks and was finally put to bed. Eight days later he sustained an attack of severe sternal pain. Nausea and then vomiting occurred. Only hypodermic injections of morphine relieved the pain. A diagnosis of acute coronary occlusion

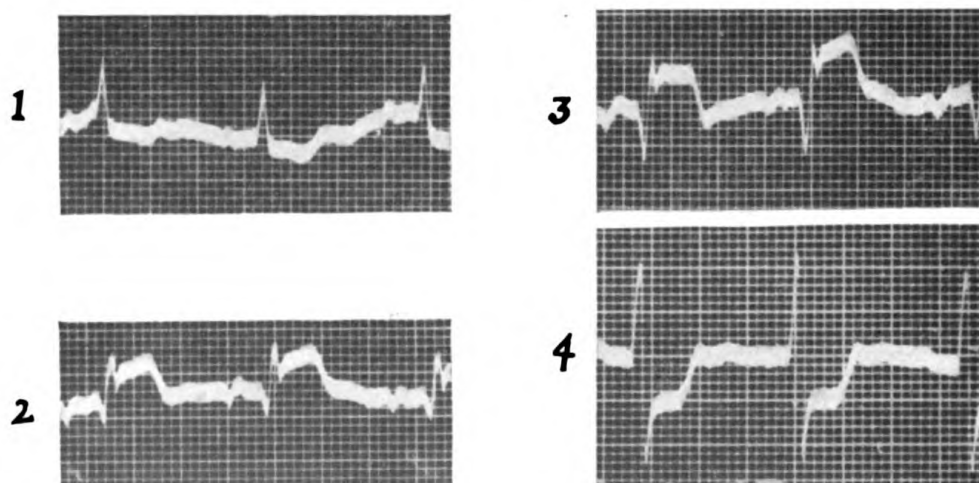


FIGURE 5.—Male, 63 years, attack of acute coronary artery occlusion, 8 February 1938. The electrocardiogram was taken 9 February, and death took place the same day. Tracing characteristic for posterior wall infarction, that is, relatively large Q-2 and Q-3, with RS-T elevations in these leads. At postmortem examination there was found an acute occlusion of the right coronary artery with acute infarction of the posterior wall of the left ventricle and adjacent septum.

was made. Two days later, 8 February 1938, the white blood cell count was 16,700 and the patient was in shock. An electrocardiogram taken the next day (fig. 5) disclosed observations characteristic for posterior wall infarction due to acute coronary artery occlusion, that is, relatively large Q-2 and Q-3 with RS-T elevations in these leads and depressions in lead 4, and a mirrorlike reciprocal relationship between leads 1 and 3. At postmortem examination 9 February 1938 there was found an acute occlusion of the right coronary artery with acute infarction of the posterior wall of the left ventricle and adjacent septum. The muscle of the left ventricular wall was completely involved from endocardium to pericardium and the septum throughout its entire thickness from left through to right ventricular cavity.

DISCUSSION

Two histories (cases 2 and 3) which were characteristic of acute coronary artery occlusion were reviewed. There were no precipitating causes: The men were in bed at the time of their attacks, one was in advanced heart failure. Severe prolonged sternal pain, not relieved by nitroglycerin, but only by morphine, shock, leukocytosis, fever, nausea and vomiting, poor heart sounds, gallop rhythm, heart failure, drop in blood pressure, elevations of the RS-T segments and large Q-waves in the electrocardiogram pointed clearly to the diagnosis of acute coronary occlusion. Autopsy confirmed not only the diagnosis but the actual surface of the left ventricle involved. The infarcts extended through the thickness of the entire wall of the left ventricle involving endocardium and pericardium. In one instance a mural thrombus was present.

COMMENT

The two main types of acute arteriosclerotic coronary disease can be distinguished one from the other; that is, acute coronary insufficiency and acute coronary occlusion.

Acute coronary insufficiency varies in severity. In the single short attack of angina pectoris due to coronary disease, the chest pain is transitory, a few seconds to minutes in duration. The incident is precipitated by exertion, excitement, ingestion of food, cold, etc., and relieved by nitroglycerin. There are no gastro-intestinal manifestations, no fever, no leukocytosis, no increased sedimentation rate. When the pain has disappeared, the patient's condition is good. The blood pressure does not fall; in fact, it may rise. If the electrocardiogram is taken during the attack, it may show transient RS-T depressions and T-wave inversions or may be normal.

In the severe form of acute coronary insufficiency in which myocardial necrosis takes place chest pain is usually more severe and prolonged. The episode is related to exertion, trauma, sexual intercourse, straining at stool, excitement and emotion, extremes of heat and cold, infection, excessive simultaneous use of tobacco, alcohol and food,

tachycardia, auricular fibrillation or flutter, hyperthyroidism and hypothyroidism. It follows shock, peripheral collapse, heart failure, bradycardia. It is a consequence of operation, anesthesia, anoxemia of many types, carbon monoxide poisoning, acute hemorrhage, hypotension, hypothyroidism, hypoglycemia, adrenalin. It results from status asthmaticus, pulmonary infarction, and embolization, particularly if they are repeated, it occurs reflexly from abdominal viscera especially if these are acutely diseased. Combinations of these causes are common.

The symptoms and signs of a severe attack of acute coronary insufficiency are those one would expect in a disease that is more serious than the simple syndrome of angina pectoris, but frequently not as grave as acute coronary artery occlusion. Hence, pain, shock, change in heart sounds, fall in blood pressure, fever, leukocytosis, and increased sedimentation rate, if present, are usually not as marked as in acute coronary occlusion. In a severe episode, the heart muscle contains many diffuse areas of subendocardial necrosis, often observed in the papillary muscles, but not involving endocardium or pericardium. For this reason, no thrombus formation on the heart wall with embolization is encountered and no pericardial rub is heard. The electrocardiogram discloses depressions of the RS-T segments and T-wave inversions (16). The localization of the myocardial necrosis to the subendocardium which is richly supplied with capillaries can be explained on the assumption that this region is most susceptible to an inadequate blood supply to the heart muscle. Furthermore, small branches from the coronary arteries turn at right angles into the heart muscle and end beneath the endocardium. Hence this area is farthest from the source of nourishment. The endocardium itself receives blood directly from the ventricular cavity. Finally the subendocardium and papillary muscles received the brunt of intramuscular pressure during the isometric phase of systole.

The therapy of acute coronary insufficiency is all important. The precipitating factor should be eliminated. In a patient with coronary sclerosis for example, the physical exertion must be limited to the myocardial reserve and a rational existence pursued mentally and emotionally; food, liquor, and tobacco taken only in moderation. The sulfonamides, penicillin, and streptomycin in infections; digitalis, mercury, and quinidine in heart failure, tachycardias, and cardiac irregularities; thio-uracil and iodine in hyperthyroidism, restitution of circulatory blood volume in shock; adequate oxygen during operation and for all types of anoxemias; repeated whole blood transfusion in hemorrhage will be preventative and curative (17). A good anesthetist and adequate supply of oxygen is more important than the type of anesthesia; cyanosis must be prevented. Even pulmonary infarc-

tion and embolism can be prevented by early ambulation of the operated patient, use of heparin and dicoumarin, and bilateral femoral vein ligation. Avoidance of these pulmonary diseases means the avoidance of one cause of acute coronary insufficiency. It is clear then that the prognosis in acute coronary insufficiency is usually better than in acute coronary occlusion. In acute coronary occlusion the treatment is symptomatic; active or drastic measures are not indicated unless complications make intervention imperative.

The second important type of acute coronary artery disease is acute coronary occlusion. This is a sudden complete closure of the coronary artery, an accidental development in progressive arteriosclerosis. The attack occurs fortuitously, at any time, anywhere, and is not related to effort and excitement. In fact, it most frequently takes place during sleep and rest, simply because the larger part of the day is spent in these states. The symptoms and signs of crushing substernal pain (not relieved by nitroglycerin), nausea, vomiting, shock, fall in blood pressure, change in heart sounds, gallop rhythm, fever, leukocytosis, increased sedimentation rate, are well known. The illness is prolonged and permanent changes in the heart are usual. At post-mortem, the coronary artery is completely closed by a thrombus formed directly on an intimal plaque, or originating from an intimal hemorrhage breaking through the intimal lining. A hematoma within the intima may cause complete obstruction of the lumen without thrombosis (24) (25). The infarct is large, extending from the endocardium through the pericardium. The resulting pericarditis gives rise to a friction rub. Involvement of the endocardium frequently results in thrombus formation and embolization. The electrocardiogram is characteristic, nay, specific (16) (fig. 4). Elevations of the RS-T segments progress steadily to inverted T-waves. The presence of large Q-waves and a reciprocal relationship between leads I and III round out the electrocardiographic findings. The RS-T elevations are associated with the pericardial and subpericardial involvement, the Q-waves with the massive through-and-through ventricular wall injury, possibly septal damage.

SUMMARY

Acute coronary artery diseases alone, with the possible exception of cancer, cause more fatalities than any other disease. Its importance is therefore manifest.

There are two chief acute coronary artery diseases: (a) Acute coronary insufficiency, and (b) acute coronary occlusion.

The concept of acute coronary insufficiency as a complete clinical entity, that is possessing definite etiological factors, pathologic pat-

tern, physiological mechanism, electrocardiographic type, and preventive and curative treatment, is new. The precipitating causes are that of the ordinary episode of angina pectoris. The myocardial anoxia may be severe and prolonged. There is a disproportion between the demands of the myocardium and the oxygen or blood available to it. Diffuse, focal, disseminated areas of necrosis may be found in the subendocardium and the papillary muscles. There is no involvement of the pericardium or endocardium. RS-T segment depressions and T-wave inversions appear (but no RS-T elevations or large Q-waves). The treatment is prophylactic, preventive, and frequently specific and curative. It may be lifesaving. The prognosis, thus, is in general better than that observed in acute coronary artery occlusion.

A case history is reported of a man who suffered from coronary sclerosis. Because of the association between an attack of severe chest pain and the death of the patient's father, and because the electrocardiogram disclosed RS-T depressions and T-wave inversions, a diagnosis of acute coronary insufficiency was made before death and an acute coronary occlusion excluded. On postmortem examination, necrosis of the left ventricular and septal myocardium was found but not involving the endocardium or pericardium. The coronary arteries revealed advanced arteriosclerosis but the lumens were patent.

The second form of acute coronary disease is acute coronary occlusion. This is a sudden complete closure of the vessel. Its onset is fortuitous, the complication of advanced arteriosclerosis in some portion of an artery. The infarct is massive, involving endocardium and pericardium with frequent mural thrombosis on the inner surface of the heart and subsequent embolization, and with frequent pericarditis. RS-T segment elevations and large Q-waves in the electrocardiogram are specific. The treatment of this disease, thus far, is of no avail. In fact, active or drastic treatment is contraindicated except in certain complications.

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PENICILLIN THERAPY IN RELAPSING FEVER

Report of Four Cases

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Treatment of relapsing fever in man by penicillin has been suggested by the work of Heilman and Herrell (1) in which mice suffering from an experimental infection of *Borrelia novyi* were treated with that agent with a mortality of 4 percent while in a similarly infected untreated group, 75 percent died.

It is therefore felt that a presentation of four cases of the disease occurring at a base hospital in North Africa and which were treated with penicillin would be of interest.

Two of the cases were among shore-based naval personnel, one was an Italian prisoner of war, and the fourth a British soldier. The first case appeared in April and the last in June 1945.

During a period of approximately 6 months, extending from January to June 1945, there was a total of 602 cases in a nearby large French colonial city (2). Of these, 84 were among Europeans and 518 occurred in the native population. There were 3 deaths in the first-named group and 29 in the latter.

The main vector of the disease in this area is the body louse while the etiological agent is the spirochete *Borrelia recurrentis*. It has been pointed out that it is almost impossible to distinguish morphologically or otherwise between the different strains of the spirochetes involved in the world-wide prevalence of relapsing fever (3).

In this section of North Africa the disease runs a moderate course of three to four or more bouts of fever with temperature ranging from 101° to 104° F., lasting 4 to 5 days, characterized by severe headache, prostration, and occasionally mild jaundice. The fever generally returns to normal by crisis on the fifth or sixth day and is followed by a remission of from 3 to 9 days. Arsenicals have been judged the treatment of choice for relapsing fever by most writers (4). At a nearby large French military hospital all patients are given routinely, once the diagnosis has been established, novarsenobil-

lon (novarsenobenzol) intravenously in successive doses of 15 cg., 30 cg., and 45 cg. One day is allowed between each injection and the course is not repeated unless the patient has a relapse, which is said to seldom occur. In that instance the third dose of 45 cg. is repeated or a larger one of 60 cg. is given. This drug is administered at any stage of the disease, and it is claimed that few, if any, toxic reactions follow this therapy.

One author (5) recommends neoarsphenamine 0.01 gm. per kilogram of body weight given in one intravenous injection and to be repeated if a relapse occurs. A smaller single dose of 0.6 gm. has also been advised (6). The use of the drug just before a crisis is about to occur, or during a relapse, is not considered advisable since it is thought that the likelihood of an unfavorable reaction is enhanced at that time by the release of toxins due to the destruction of spirochetes. Cases of relapsing fever which have proved refractory to arsenicals have been reported by certain workers (7) who used bismuth preparations with good results.

CASE REPORTS

Case 1.—A 25-year-old male Negro, steward's mate, was admitted on 25 April 1945 from a receiving station with history of fever of 2 days' duration. During this time he had been treated at the receiving station sickbay and a blood count, malaria smear, and x-ray of chest had yielded no relevant information.

Physical examination revealed an acutely ill Negro male with a slight icteric tinge to sclera. Temperature was 104° F., pulse 120, and blood count showed a leukocyte count of 8,000 with a differential blood smear within normal limits. The hemoglobin was 60 percent and the red blood count 3,020,000. Urine, smears for malaria, and Kahn test were negative. Since it was felt that the patient was suffering from a very severe generalized infection, an initial dose of 40,000 units of penicillin followed by 20,000 units every 3 hours was given intramuscularly.

On the day following admission, slight tenderness over the liver area was noted. An icterus index was 37. The drug was stopped after 80,000 units had been given as it was felt that since the patient probably was suffering from acute hepatitis, it would be of no value. On 27 April 1945 the spirochete *Borrelia recurrentis* was noted in a routine blood smear stained with Wright's stain. A darkfield examination of a wet blood smear preparation confirmed the diagnosis of relapsing fever.

Upon questioning, the patient stated that he had received insect bites some days prior to the onset of the illness when he had mingled with the native population while on liberty. As the optimum amount of penicillin necessary to effect a cure in relapsing fever was not known it was decided to give the patient the drug in the dosage and over the same period of time as proscribed in therapy of early syphilis: viz, 40,000 units every 3 hours for 7½ days (total 2,400,000 units). The patient's temperature which had been fluctuating between 102° and 105° F. returned to normal by crisis on the following or sixth day of the illness after 200,000 units had been given and except for a slight (101° F.) transitory rise 2 days later remained within normal limits during the rest

of his hospital stay. Spirochetes were not found in wet blood film preparations the day after treatment was started or at any time throughout the period of treatment or during the 27 days of observation following the conclusion of penicillin therapy. The liver tenderness disappeared and icterus index gradually returned to normal while the secondary anemia responded well to hematinic therapy.

He was discharged on the thirty-fifth day following admission. During his hospital stay he had received a total of 2,880,000 units of penicillin (including 80,000 units given during first 2 days of the disease).

Case 2.—An Italian prisoner of war, 22 years of age, was admitted on 10 May 1945 with a 2-day history of fever. Three days previous he had been discharged from the hospital, after having been a patient for 17 days, during which time he had been treated for a febrile illness characterized by chills and temperature fluctuation of from 99° to 104° F. Physical findings on that admission and all laboratory study including repeated smears for malaria had yielded no basis for a definite diagnosis. However, in view of a history of repeated attacks of malaria he had been given a course of quinaquine dihydrochloride (atabrine) (3 grains every 6 hours for five doses and then 1½ grains three times a day for 6 days). His temperature had fallen to normal 3 days after this therapy had been started. The febrile period of that illness had lasted 7 days and during the remainder of his hospital stay of 10 days he had run an uneventful course.

The pyrexia and symptoms which had initiated his present admission had begun on the day after he had returned to camp or 11 days after the temperature of his previous illness had subsided.

Examination revealed a fairly well-nourished, acutely ill white male, temperature 101° F., pulse 88, and respiration 24, complaining of severe frontal headache. There were no definite positive physical findings. Eight hours following admission, his temperature rose to 104° F. A blood smear taken for malaria was reported positive for spirochete *Borrelia recurrentis*. The leukocyte count was 8,900 with a normal differential. Hemoglobin and red cell count were within normal limits and a Kahn test was negative. Through an interpreter the patient denied any history of insect bites and re-examination revealed no evidence of suggestive skin lesions.

It was then decided to see if it was possible to obtain a successful therapeutic result with approximately half the amount of the drug used in the first case. Accordingly penicillin 40,000 units was to be given every 3 hours for 3½ days.

The patient's temperature fell to normal by crisis on the following day after he had received a total of 120,000 units and remained within normal limits during the rest of his hospital stay. Repeated examinations of blood smears by dark-field technique were negative for spirochetes. While undergoing treatment he developed a leukopenia ranging from 3,200 to 3,800 with a normal differential. The leukocyte count rose to within normal limits toward the end of the 17-day observation period following the conclusion of penicillin therapy. The patient was discharged after having received a total of 1,100,000 units (for the last 3 doses only 20,000 units, instead of 40,000 units, were given).

Case 3.—A British soldier, white male, 37 years of age, was admitted from a training camp in the vicinity of the hospital unit on 15 May 1945, with a history of fever and sore throat. The onset of his illness, accompanied by chills, occurred 2 days previously. Temperature was 102° F., pulse 120, and respiration 20.

Physical examination was essentially negative except for moderate injection of posterior fauces and tonsils. There were no skin lesions suggesting insect bites,

nor did the patient give any recent history of contact with the native population. Routine laboratory study yielded no relevant findings and the Kahn test was negative. Spirochetes of relapsing fever were discovered in a blood smear stained with Wright's stain on the day following admission.

It was decided to treat the patient with 40,000 units of penicillin every 3 hours for 24 hours only, to see if this amount of the drug would control the present attack and prevent a relapse. In 24 hours, and after 320,000 units had been administered, the patient's temperature fell to normal by crisis. During the next 9 days he was afebrile, had no complaints and repeated darkfield examination of wet blood film preparation did not reveal any spirochetes. On the ninth day following the crisis his temperature rose to 102° F. The next day spirochetes were again found on darkfield examination and the patient was placed on penicillin, 40,000 units every 3 hours. On completion of 2 days of this therapy patient's temperature, which had been fluctuating between 99° and 104° F. suddenly fell to normal by crisis after 400,000 units of the drug had been given; 20,000 units of penicillin every 3 hours for 8 doses was then given, and the therapy was discontinued, a total of 880,000 units having been administered. Following an uneventful 12 days' period of convalescence, during which repeated examinations for *Borrelia recurrentis* were negative and routine laboratory study, including Kahn test, yielded no positive findings, the patient was discharged to duty.

Case 4.—A 27-year-old seaman, second class, was admitted from a shore-based activity with a history of fever of 5 hours' duration. His temperature was 102° F., pulse 136, and respiration 26. Physical examination was essentially negative and there were no lesions present suggestive of insect bites. Routine laboratory tests, including smears for malaria, presented no positive findings and x-ray study of the chest yielded no relevant information. The patient was placed on sulfadiazine and sodium bicarbonate therapy (15 grains of sulfadiazine and 10 grains of sodium bicarbonate every 4 hours). His temperature fluctuated between 102° and 105° F. On the third day following admission, spirochetes of relapsing fever were discovered in wet blood film preparations by darkfield examination. Sulfadiazine was discontinued after a total of 13 gm. had been given and penicillin 40,000 units every 3 hours was started. The patient's temperature fell to normal by crisis after he had received 360,000 units, and he remained afebrile and asymptomatic during the rest of his hospitalization. Penicillin was discontinued after a total of 1,560,000 units had been administered. Repeated darkfield examinations of wet blood film preparations for spirochetes were negative and following a 12-day period of observation patient was discharged to duty.

COMMENT

Our small series does not permit any authoritative statements on our part with reference to penicillin therapy in relapsing fever, and probably does not represent a fair trial of that agent in this disease. However several interesting aspects of our study are worthy of brief comment. Only one of our cases (case 1) was of marked severity. In two of the cases (1 and 4) the course of the disease was definitely altered by the administration of penicillin since the patients never suffered a relapse. Undoubtedly in case 3, a second relapse could have been prevented by a longer course of therapy. Case 2, in retrospect, probably had his first attack on his previous admission to the

hospital, and was treated with penicillin during his relapse. While he, as well as the patient in case 3, was probably prevented from having further relapses by penicillin, the fact must not be overlooked that occasionally the disease may limit itself to two febrile episodes and that therefore both of these cases might have escaped further relapses without the use of this drug.

We do not feel that the amount of the drug administered before crisis took place was significant. In all the cases, penicillin was not started until the patient had been ill for 2 to 3 days. The bouts of fever in this disease are variable in length (from 3 to 6 days) and the patient might have had a natural crisis rather than one initiated by the therapy. Estimation of the blood level of penicillin was not practical here. The optimum dose for preventing a relapse, as suggested by our small series of cases, would seem to be between 1,560,000 and 2,800,000 units, 40,000 units being given every 3 hours. It is of interest to note that 13 grams of sulfadiazine given in case 4 did not alter the course of the disease. A large number of patients will have to be treated and studied before it can be said that penicillin is a more effective agent in relapsing fever than the arsenical preparations, several doses of which will generally effect a rapid and complete cure.

Possibly penicillin might be of value in cases which prove refractory to arsenical therapy as well as being the choice in individuals sensitive to these drugs. The fact that it probably can be given safely during any stage of the disease, without danger of reactions, might further recommend it.

SUMMARY

1. Four cases of North African relapsing fever treated with varying doses of penicillin are presented.

2. In two of these cases, the course of the disease was definitely altered by the therapy, since they did not suffer any relapses. A third case, which might have escaped a relapse if a longer initial course of the drug had been given, received a second course and was cured, as was the fourth patient treated during the first relapse.

3. The optimum therapeutic amount of penicillin would appear to be between 1,560,000 and 2,800,000 units given in 40,000-unit doses every 3 hours intramuscularly.

4. It is felt that a much larger series of cases of relapsing fever will have to be treated and studied before it can be determined that penicillin has any great advantage over drugs now being used in treatment of the disease.

ACKNOWLEDGMENT.—The authors wish to express their appreciation to Lt. Comdr. E. A. Fullgrabe (MC), U. S. N. R., medical officer in charge of Epidemiology Unit No. 23, for his aid in the preparation of this paper.

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STIMULATING ACTION OF ACETYLCHOLINE ON THE HEART

Author's summary.—1. It is shown that acetylcholine can, in certain circumstances, stimulate the heart. This occurs when it is administered in small doses to suitable hearts or at the commencement of the action of large doses or, with large doses, if the better known inhibiting action of the substance is abolished by atropine or methylene blue.

2. The stimulating action is enhanced by eserine after atropine, but may be abolished by ergotoxine or large doses of atropine

3. The stimulating action is seen after the administration of nicotine in sufficient dosage to paralyze autonomic ganglia and if the ventricular muscle is driven electrically. It therefore appears to be a direct action on the cardiac muscle.

4. The effect, compared with that of adrenaline, is more on the force of the heart than on the frequency. The possible significance of these facts in the intact animal is discussed.

Note added in proof.—Since this paper was submitted, a paper by Hoffmann, Middleton & Talesnik (*Amer. J. Physiol.* (1945), 144, 189) has appeared confirming the main results and adding the observation that the stimulating action of acetylcholine is abolished by curare and is accompanied by a release of adrenaline into the coronary outflow. * * *—McDOWALL, R. J. S.: Stimulating action of acetylcholine on the heart. *J. Physiol.* 104: 392-403, April 1946.

MULTIPLE PULMONARY CALCIFICATIONS

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The recent investigations of Christie and Peterson (1) (2) Palmer (3), Aronson Saylor, and Parr (4), Smith (5), and others have served to focus the attention of expert medical opinion in mycology, roentgenology, and the study of tuberculosis on pulmonary parenchymal and hilar calcifications. Once considered almost universally as *prima facie* evidence of pulmonary tuberculosis, multiple scattered parenchymal calcifications or massive hilar calcifications are now subjected to critical re-evaluation.

One of the most profitable sources for investigating the incidence and variations of thoracic or pulmonary abnormalities is mass photo-roentgenography. Such studies as those of Long and Stearns (6) serve well to illustrate this. For this reason, 110,000 consecutive 35 mm. photofluorographic examinations of the chest from 2 January 1945 to 7 January 1947 were reviewed to determine the incidence of pulmonary calcifications of a disqualifying nature (Manual of the Medical Department, 2163 (g) (3)).

The 110,000 examinations represented those performed at a large naval training center for entrance into the service, separation from the service, and for routine annual examination of male and female officer and enlisted personnel. All cases seen to contain multiple areas of calcification in the lung parenchyma, or massive hilar calcification were taken again on 14" x 17" films. Care was exercised to exclude those cases in which "en face" blood vessels simulated calcific deposits. In selected cases stereoscopic and oblique studies were performed. No attempt was made in this study, admittedly unfortunate statistical omissions, (a) to include those cases considered as single, "double," or "triple" primary foci or complexes—in other words, those cases of hilar or parenchymal calcification not considered disqualifying—or (b) to correlate the findings with the patient's State residence.

A total of 102 such cases, an incidence of 1 to 1,079 was present. These cases were arbitrarily placed in 2 groups, a classification found by experience to be useful in reporting such cases (table 1). Type I occurred when the calcified lesions were uniformly distributed from

apex to base in both lung fields, usually all of the same size, and frequently of such great density as to be countless (fig. 1). It is difficult even by the most rigid standards of logic to deny that these lesions are the result of a hematogenous dissemination of the causative organism. Type II referred to those cases of multiple calcified lesions, irregularly scattered in the lung parenchyma, with no apparent sym-

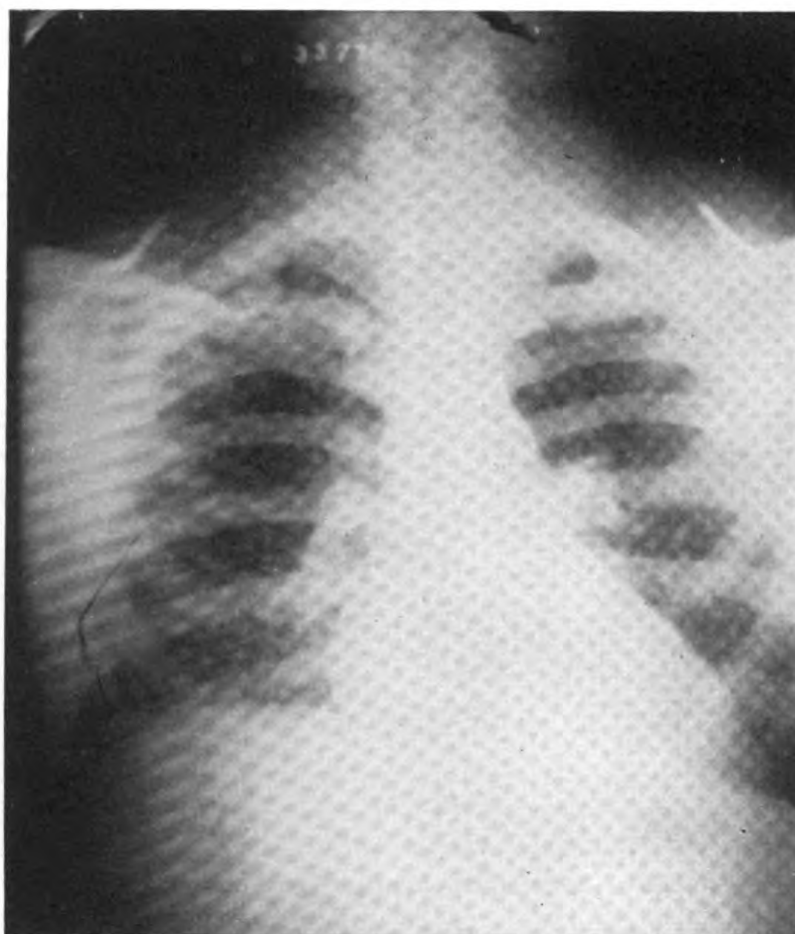


FIGURE 1.—Type I, disseminated "miliary" calcifications.

metrical distribution and with lesions frequently of varying size (fig. 2). Such variation, although not precluding a hematogenous source of infection, tends to indicate multiple primary areas of infection, or bronchogenic dissemination. A fair assumption, if hematogenous dissemination had occurred, is that such spread involved a small number of viable causative organisms.

It is obvious first of all, that the classification although useful in practice, is primarily one of degree and not of kind. No classification based on the number of lesions present could prove entirely satisfac-

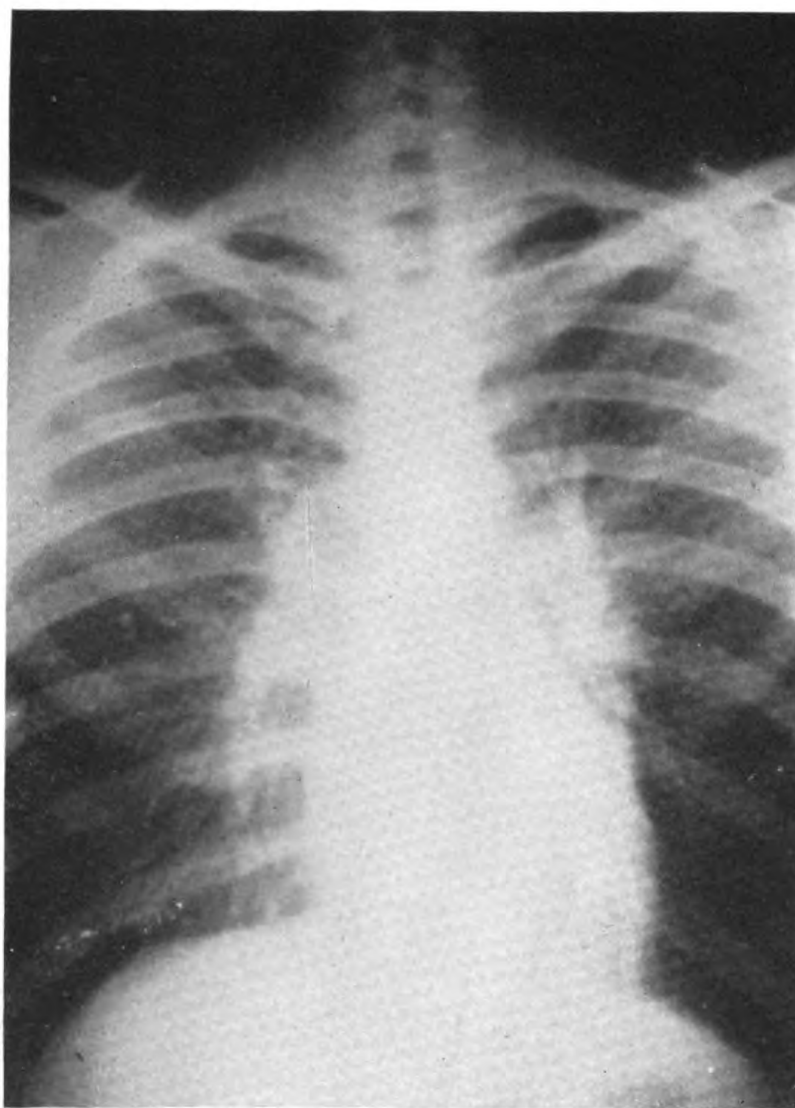


FIGURE 2.—Type II, irregularly scattered calcifications.

tory except pragmatically, for naval purposes, such as determining the eligibility of a recruit.

Second, no attempt was made to establish an etiologic diagnosis of the lesions. No longer can one call such lesions healed hematogenously disseminated tuberculosis or any form of tuberculosis, with certainty. Facilities for performing routine histoplasmin skin sensitivity tests on patients showing such lesions were not available. It is conceded of course that in many cases the differentiation between tuberculosis, histoplasmosis and some other perhaps as yet unrecognized pulmonary disease, mycotic or otherwise, would be impossible. There is, however, in a group of cases such as these, a fertile field for statistical study.

TABLE 1.—102 cases re-examined classified by groups

	Number of cases	Incidence
Type I. "Miliary" uniformly distributed calcifications	21	1:5,238
Type II. Multiple irregular calcifications or massive hilar calcification.....	81	1:1,358
Total.....	102	1:1,079

It would therefore be advantageous, if the facilities at those naval activities where large scale 35 mm. photofluorography is performed on incoming naval recruits, were augmented so that all indicated diagnostic procedures could be performed. In this way the growing body of knowledge pertinent to multiple pulmonary parenchymal calcifications would be swelled by naval recruit statistics. Having the results of such indicated procedures included in the stations' periodic 35 mm. photofluorographic reports to the Bureau of Medicine and Surgery would assure such information becoming incorporated in the accumulated knowledge of medical science. Merely to determine the eligibility of a naval recruit, although the prime purpose of the examination, without any investigation into the nature of the condition, does not aid scientific advancement and achievement. We remain arbiters, and the phenomenon we are arbitrating remains an obscurity.

SUMMARY

1. One hundred and two cases of multiple pulmonary parenchymal calcification in 110,000 consecutive 35 mm. chest photofluorographic examinations were present. These cases were of a disqualifying nature for entrance into the naval service.

2. No attempt was made and no facilities were available to investigate by known diagnostic methods, primarily histoplasmin skin sensitivity tests now available, the nature of the lesions.

3. Such procedures should be a part of the recruit enlistment physical examination program of the Navy, to add naval statistics to the body of knowledge on pulmonary calcifications.

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THE TREATMENT OF UNDULANT FEVER

"This contribution covers much ground and is of no little interest. The author opens with a historical sketch * * * then proceeds to his main thesis, a discussion of the treatment of undulant fever. He has studied the clinical histories in the files of the Hospital del Rey, Madrid, throughout the 14 years from its foundation in 1925 to 1939 * * *

"The various methods may be grouped under three main heads: (1) Chemotherapy; (2) Vaccines; (3) Protein Shock.

1. *Chemotherapy*—Pyramidon (Amidopyrine) was used for 48 patients—in many combined with specific formomelitin. This is referred to below. *Arsenic* in the form of neosalvarsan was used in 19 patients. It was given intravenously. The usual dose recommended was 0.15 gm. to start with and to increase gradually to 0.9 gm., but if the patient's weight did not exceed 60 kgm., the highest dose was never above 0.6 gm. The author states that the usual maximum dose was 0.45 gm., the injections being given weekly as a rule. *Sulphonamides* were given to 15 patients: 10 received prontosil in doses from 1.5 to 3.0 gm. daily for 20 days; three were given 15 cc. of 5 percent. *Azol* intravenously for 11 to 17 days; the remaining two had 15 cc. of 5 percent, prontosil intravenously together with 3 gm. of sulphathiazole daily for 4-6 days. Briefly, the sulphonamides, except insofar as having an action on some concomitant streptococcal or foliiform infection, did not appear to affect the course of the disease itself. As regards *gold*, this was employed in the form of *Orosanil* in 29 cases. The initial dose was 0.01 gm. and was administered intravenously, increasing to a maximum of 0.05 gm., "every third day" (this is explained as meaning a 2-day interval between injections). Good effects were obtained in 21 of the patients and no case ended fatally, although some of the patients were very seriously ill. In short the author speaks more highly of this than of any of the other methods of treatment.—FIGUEROA, EGEA, J.: Treatment of undulant fever. *Rev. Sanidad e Hig. Publica.* 19 (Nos. 4, 5, & 6): 237-256; 326-412, Apr., May, and June 1945; *Bull. Hyg.* 21: 26-27, Jan. 1946.

A TECHNIQUE FOR ROOT CANAL THERAPY AND ROOT RESECTION AS AN AID TO THE PROBLEMS OF A DENTAL OFFICER AFLOAT

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In our Navy, both at home and here at sea, there is a crying need for conservative treatment of infected anterior teeth. The men we care for are particularly susceptible to injury in the region of the incisors. Liberty parties exact their toll in broken and traumatized teeth. The nature of routine duty aboard destroyers, destroyer-escorts, and submarines especially accounts for a great many more injuries to these teeth. The easiest method of dealing with these unfortunate situations is that of extracting the offending teeth and when we are busy enough with routine dental treatment it is easier still to justify ourselves for extracting rather than conserving. Having extracted the teeth, are we not being short-sighted? The immediate problem is solved but a new one has been introduced; a bridge is now indicated and the patient will be forced to go about minus an anterior tooth until time is found in which to construct the necessary prosthesis.

Many of these teeth can be saved with a concomitant saving in operating time by root canal treatment. When teeth are obviously infected and show evidence of granulomatous areas about the apex, they may be filled and a simple apicoectomy performed subsequent to filling.

I have had occasion to fill and treat a number of teeth in this manner and the results are very satisfactory and gratifying. Any dental officer who has had duty aboard ship has had instances of men coming aboard from other vessels with an availability of only a few days for dental work. They often present a discolored tooth with a necrotic pulp or an incisor that someone has opened and left to drain, perhaps 3 months before. Obviously with a limited time at his disposal the dental officer has only two alternatives, extraction, or root filling and root resection. I prefer the latter plan whenever possible because of its many benefits to all concerned, and because I have personally felt throughout my professional career that it is a duty and more blessed to conserve rather than to destroy.

The technique to be described for cleaning and filling of the root canal is adequate for all types of conditions and teeth. The degree of infection and periapical involvement will influence the course of treatment subsequent to the filling of the canal. In carious exposure or in surgical exposure of the pulp canal, which does not involve periapical infection, cleaning, sterilization, and filling with the prescribed technique will be sufficient. In cases of suppuration and granuloma formation at the root apex, I prefer to follow the filling by root resection. This plan of treatment precludes the long period of dressings and drainings of the teeth involved and therefore appeals to patient and operator alike.

PREPARING THE CANAL FOR FILLING

Now to describe the cleaning and filling of the root canal. The tooth is anaesthetized, isolated, scoured with pumice, rinsed and painted with merthiolate or 70 percent alcohol on the lingual surface. The pulp is invaded with round burs and the opening is enlarged by means of the cross-cut fissure burr, sufficient to provide easy access directly in a line with the root canal. This is a very important factor in expediting the cleaning of the canal with files and broaches. Failure to provide easy access only serves to complicate matters and to make the work more difficult. A fine barbed broach is introduced gently toward the apex until resistance is encountered. If there are curves evident in the canal the broach is bent to conform to them, using the x-ray as a pattern. The broach is then twisted slowly and withdrawn. At times it will carry with it the entire pulp intact; on other occasions when the pulp is destroyed, only hemorrhage and parts of diseased pulp will be withdrawn. This procedure is repeated using larger and larger broaches and being careful never to push the broaches far enough to become bound in the constriction of the canal. If at the end of this operation bleeding is profuse and difficult to control, a cotton point saturated with epinephrine solution is forced into the canal and allowed to remain for a few minutes. This is usually sufficient in arresting the most stubborn hemorrhage. Using the finest file available, measure approximately the length of the tooth in the x-ray and introduce the file. Generally this fine file will follow the canal as far as the apical foramen. If not, by flooding the canal with 25 percent sulfuric acid and then by forcing the file gently and twisting at the same time it will gradually penetrate the constricted portion to the apex. With successively larger files, the canal is enlarged, the acid softening the inner surface of the canal and dissolving the organic contents. The acid will also penetrate through any accessory canals that may be present. At this time, neutralize with the saturated

solution of sodium bicarbonate and rinse with copious amounts of hot water. Examination of the canal will now reveal a clean white surface and a canal wide enough to make filling a simple matter.

FILLING THE CANAL

In filling the canal we are going to try to do two things. First, to fill the canal and its accessory canals if any are present. Second, to force a small amount of the filling material beyond the apex. The filling material tends to shrink slightly and if a small excess is forced out of the canals as it shrinks, in later months it tends to shrink down on the opening of the canal much in the nature of an inverted plunger, the handle being that part of the filling extending from the canal to the apex.

Having cleaned the canal thoroughly as already outlined, it is dried and 95 percent alcohol is flushed in the canal by means of the syringe. This is dried out with air and then dried with sterile absorbent points.

A suitable gutta-percha point is tried for length and then the dried canal is flooded with a solution of chloroform and resin. Whenever introducing any solution into the canal, a cotton roll is held lingual to the needle and the excess is not spilled but absorbed by the cotton and the field is kept neat and clean. Now the point is introduced and gently pumped up and down in the canal. The chloroform softens and dissolves the surface and a creamy mixture of chloropercha is formed in the constricted portion of the canal. The point is now pushed and packed under pressure as far as it will go. More and more points are introduced until the canal is densely filled with the gutta-percha chloresin mixture.

What takes place in the canal is that this sticky creamy filling material is forced through the apex. The excess chloroform is driven off and the resin gutta-percha mixture is left in place tightly adhering to the walls of the canal. The little button of excess shrinks later and seals off the opening. The filling is x-rayed and if satisfactory, the patient is dismissed and a permanent filling placed over the root filling at a later date. Occasionally the tooth will become tender but this is not unnatural and usually ceases after 36 hours.

ARMAMENTARIA

[In order of use]

- Round burs No. $\frac{1}{2}$, 2, and 6.
- Cross-cut fissure bur No. 560.
- Barbed broach—fine, medium, and large.
- Kerrs files, style B.
- Luer lock type glass syringe.

23-gage 1½-inch needle with the point blunted.
Sulfuric acid 25 percent.
Saturated solution of bicarbonate of soda.
Hot water.
Solution of epinephrine.
Alcohol 95 percent.
Assorted sizes of cotton absorbent points.
Chloroform and resin solution.
Kerr root canal pluggers.
Assorted gutta-percha root canal filling points.

The performance of an apicoectomy is a very simple undertaking. Anesthesia is induced by injecting high over the apex of the tooth involved, usually 1½ cc. novacaine is sufficient for laterals and cuspids of the upper arch. When a central incisor is to be treated another ½ cc. is deposited over the adjacent central incisor to take care of any overlapping of nerve distribution. On the palatal side about ¾ cc. novacaine is injected into the anterior palatine foramen. These injections usually do away with all pain although on occasion when the granulomatous area is deep-seated, difficulty is encountered in producing complete anesthesia.

An elliptical incision is now made half way up the root, with the curve projecting incisally and cutting down to the alveolar bone. Then with suitable periosteal elevators the flap is raised and the alveolus over the root apex laid bare. The patient closes his teeth and the flap is retracted and by means of a bone bur the overlying alveolus is cut away exposing the apex of the tooth and the area involved. The apical portion of the tooth which is involved in the infected area is then amputated with a 702 tapering cross-cut fissure bur. The infected area is scooped out with curettes or large round burs until a hard, clean surface remains. An aspirator is a helpful adjunct throughout the operation in maintaining a clear operating field. Finally the root end is smoothed with files or burs and the cavity flushed thoroughly with warm physiological salt solution, filled with sulfathiazole powder and a suture placed closing the flap.

This type of operation rarely causes any postoperative discomfort. The patient is instructed to apply intermittent cold compresses for about 3 hours following the operation. This minimizes any swelling that may occur. On the third day the suture is removed. The time consumed in filling the root and the resection can be cut down with experience. An hour and a half is ample time for most cases.

The work involved is satisfying to the operator in the good service rendered, of great benefit to the patient since he retains his tooth and is not faced with the necessity of injuring adjacent teeth for crown and bridge construction, and the Navy is relieved of the responsibility, expense, and loss of time involved in restorative work.

EMOTIONAL DISTURBANCES ENCOUNTERED IN CARRIER PILOTS

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Many papers have appeared in recent months pertaining to the psychiatric casualties of war. Often they deal with the pathology and mechanisms of definite neuroses and have little practical value to medical officers inexperienced in psychiatry. The following discussion is an attempt to clarify the emotional problems encountered among carrier pilots, and point out their relationships to morale, leadership, and problems within the air group. The practical aspects of proper disposition of fatigued aviation personnel will be considered. The data presented are based on observations of various air groups in combat.

ORIGIN

Although emotional disorders are a predominant problem among carrier pilots, they are rarely the typical established neuroses as reported in ground troops but are the less apparent mild depressions with slight personality changes and loss of flying ability.

As in other fields of military neuropsychiatry, fear is the basic cause of these disturbances. The conflict which arises between a man's normal instinct for self-preservation and the hazards of carrier flying and flying in combat necessitates continual suppression of fear. After various periods of time, tension and anxiety reach a point where emotional disturbances occur.

Actually, among fleet aviators, the over-all incidence of marked anxiety is low for several reasons. The average pilot has enough education to analyze the components of a situation which threatens his security and through rationalization convinces himself that his chances for survival are fairly good. More important, however, is the fact that every flying man must become adapted to a certain amount of fear during training. From the earliest days of his career when he overcame the normal fear of falling until his last qualification carrier landing, he has been faced with dangerous situations. He becomes so thoroughly acquainted with fear that he soon takes it for granted and the additional hazard provided by actual combat affects him little at first.

There is a wide variation in individual tolerance to the strain of combat and very little correlation between flying ability and ability to withstand the stress of battle. Likewise, a man's physical make-up is not important and his tolerance apparently depends on less tangible factors. Under the popular concept of pilot fatigue, it is assumed that, as the strain increases, suppression of fear becomes more and more difficult and, varying with the individual concerned, reaches a point at which the anxiety can no longer be tolerated. Some men are endowed with a high tolerance, others with a very low tolerance and therefore under this reasoning, a man who succumbs early is not subject to discipline. However, from a practical standpoint the judgment of an individual on this basis must be qualified by other factors.

In general, the men who yield under the strain can be classified into three groups. In the first are those neurotically predisposed individuals who would probably have some difficulty in adjusting themselves even to the conflicts of normal civilian life. They often are men whose family environments have been unsatisfactory from childhood, punctuated by divorce, hatreds, alcoholic, or neurotic parents. Part of this group drop out during operational training before reaching the fleet, others after their initial contacts with the enemy.

Case report.—A 25-year-old torpedo plane pilot had served a previous tour of duty in the Pacific which lasted 4 months and included no combat. Following an 8-month training period in the United States he again went to sea. After his second raid over enemy territory he ran out of gas, landed on the water and was picked up by a destroyer. At that time he received a minor injury to his knee which he later attempted to use as an excuse to get out of combat flying.

This pilot was the son of divorced parents, had lived part of his life with maternal grandparents, married following graduation at Pensacola, and had become very dependent on his wife. His aviation motivation was poor and he apparently got into naval aviation the same as he would apply for a job, the "glamor" and extra pay being a strong incentive.

In the second group are the normal stable individuals, who, after being subjected to long strain, finally abandon the struggle. At the stage of the war when this article was written, few in this group were affected due to squadrons being relieved on a regular rotating basis. However, in the early months of the war, necessity dictated the employment of carrier pilots far beyond the normal limits of tolerance.

In present-day fleet air groups, attacks of extreme anxiety in otherwise normal pilots are not uncommon after long weeks of combat. These attacks come as a result of repeated exposure to danger in a man who is already suppressing his fear with great difficulty.

Case report.—A 29-year-old Hellcat pilot had been engaged in continuous hard combat for 8 months during which time he had run up an impressive score in enemy aircraft destroyed. His aircraft had been hit by gunfire several times and twice he had made forced landings at sea. Following one strike he returned

with considerable damage to his engine and as he approached the stern of the ship with the motor smoking and missing, it suddenly failed at a critical point. By good fortune and skill he landed on the first few feet of the deck. After this he lost his sense of security in an airplane and had occasional attacks of extreme anxiety. Yet, despite this, he continued to fly, completed the tour of operations and further increased his score.

Case report.—A fighter pilot, 23-years-old, had been in continuous combat for 9 months and during this time had shown that he was an able and aggressive pilot. Within a period of several days he was caught by an enemy fighter and received such severe damage to his plane that he was forced to parachute, lost a close friend in combat, and on two occasions while taxiing up the deck had been rammed from behind by landing aircraft which crashed through the barrier and destroyed part of his plane with their propellers. He was a competent officer, very stable emotionally, and had a strong sense of responsibility. He controlled his mounting anxiety, continued to fly and finished the tour in a satisfactory manner. Four months later he was in a midair collision, was forced to parachute again, and was seriously injured. He was removed from flying.

There is a third group, extremely small, in which the individuals apparently have unlimited tolerance to combat. They apparently are men who unconsciously convert their fear into aggressive action.

SYMPTOMS OF EARLY FATIGUE

The *carrier landing*, since it demands a high measure of skill, reflects small changes in performance ability and therefore is an excellent indicator of early fatigue provided the observer watches all landings at every flight quarters. Close association with the landing signal officer is necessary since he is often the first to notice a change. A pilot who has previously made consistently good landings may suddenly become erratic or most commonly begins to approach high and fast in an effort to increase his margin of safety.

Irritability is an early and prominent symptom. The individual finds fault with everything and angers easily. He may indulge in much unjust criticism of the airplane and the ship. In one instance, a pilot became annoyed because he was ready to land aboard and the ship had not turned into the wind. As an expression of his annoyance, he deliberately delayed his landing after the ship was turned into the wind, to the extreme inconvenience of an entire task force.

Difficulty in falling asleep is common, due to tension and inability to relax. Sleep is often interrupted by dreams, usually reproducing some dangerous phase of combat. The pilot lies awake and worries about some particular part of flying, such as landing aboard, enemy gun fire, or the possibility of a crash landing at sea with subsequent explosion of the depth charges in his bomb racks.

Tremor is uncommon but *mild gastro-intestinal symptoms* are frequent. Men with a neurotic background are particularly prone to

somatic disturbances and are quick to use a symptom as a motive for seeking medical assistance and removal from flying.

Active treatment in the form of narcosis and heavy sedation is not practical at sea. Temporary grounding and the liberal use of phenobarbital is valuable as a temporary measure. Whisky in 2-ounce portions is useful as a sedative but has been generally over-rated and is inferior to sedative drugs.

REMOVAL OF PILOTS FROM FLYING STATUS

There is a tendency among medical officers to ground flyers without sufficient justification. This may be partially due to a physician's natural sympathy toward human shortcomings but more often a man is grounded and shipped to a shore station simply because it is the easiest solution to what may be a difficult problem to all concerned. On a carrier the prime factor to consider when grounding a pilot is whether or not he is safe to fly. This becomes foremost long before his mental status requires his removal from flying simply because the lives of many people are involved each time he lands aboard.

For this reason, it is probably true that carrier pilots have to be grounded much sooner than land-based personnel. Since a pilot's difficulties in the air are an outgrowth of his increasing anxiety, it becomes the medical officer's duty to make the decision. However, since it also involves the man's professional qualifications to fly, the group commander and other aviators must all work in the closest harmony with the medical officer. In this sense, it is a dual responsibility of the Line and the Medical Corps.

Unfortunately, no matter how tactfully handled, there is a stigma associated with being grounded and therefore some effort should be made to keep a pilot flying as long as is consistent with safety and his mental health. A man who has been permanently grounded aboard an aircraft carrier must be disposed of quickly. It is harmful for him to watch his companions fly while he remains on deck "sweating out" the strikes in which he once participated. The others resent his presence because he failed to finish the race.

They should be retained under the diagnosis of combat fatigue, and care used that the term "psychoneurosis" not be allowed to enter the picture. Even the word "anxiety" which supposedly represents the apprehension associated with danger, has been used carelessly to the injustice of many pilots.

PRACTICAL CONSIDERATIONS

As previously stated every man has a definite tolerance to the strain of combat and the wide variation in the breaking point is due to a difference in the endowment of each individual. Under this conception, a man who must quit flying early is not subject to punishment

since his failure is due to his own imperfection. But approaching the problem from a practical standpoint, the judgment of an individual on this basis must be qualified by other factors, namely, his honesty and his contribution to combat.

When a man's instinct for self-preservation dominates his actions, he begins to play it safe. If he is honest, he will come and tell the medical officer that he can no longer press his attacks. This might save many lives which would otherwise be endangered. If he is not honest, he will continue to fly in order to maintain his self-respect, but once over the target, will retire to a safe distance. In the early part of a cruise, this is a disciplinary problem, provided he can be caught. But toward the end, no one can deny that it is a part of a man's normal reaction to his increasing fear. Although at first it is the problem of the squadron commander, later it becomes a medical problem.

Some men tend to "pull their punches" all the way through. A man's behavior over the target is not easy to check, since everyone is busy with his own duties. Only a few know whether a man pulls out at 5,000 feet or shoves off into a cloud, and most pilots are extremely reluctant to name a man who has defaulted. Unless his failings are noticed by the leaders, they pass undetected. It is obviously important to eliminate these individuals early, since it avoids much later difficulty for the medical officer.

Careful distinction should be made between these two types of individuals—the one who admits early that he is having trouble and stops flying before lives are endangered and the other who continues more to maintain his self-respect than to fight. Both are medical problems but certainly do not warrant the same consideration. In the Navy, decisions regarding disposition of pilots are made by a board convened on the ship. These men are close to the airman concerned, know his background, combat record, and can ably recommend a specific reclassification.

The problem of distinguishing between fear and cowardice is always left to the flight surgeon. If he excuses a coward for medical reasons, it is not only a reflection on him but it lowers group morale. Cowardice must be dealt with in a sharp, decisive manner. Pilots who are returned from combat zones because they are incompetent must not be awarded safe jobs ashore and routine promotions. It is wrong to detach such a person and assign him shore duty. The British classify this as "lack of moral fiber" and treat it by the most stringent measures.

Apparently this type of man has little of the normal conflict which arises between duty and self-preservation. He is closely concerned with himself alone, transfers very little of his interest to the squadron, and has little pride in the air group. He does not fight because of a

strong sense of duty but because he fears the consequences which await him if he fails. This is poor motivation and early in his career he quits rather than expose himself longer.

PREVENTION

In considering prevention, many apparently far-related factors are found to be involved. Selection, mental prophylaxis, morale, leadership, and the success or failure of the group as a whole must be considered. The role of the medical officer is important, particularly his relationship to the individual pilots. He will find that he is called upon to make moral decisions for the group and although this is not strictly within the premise of medicine, he, the doctor, is often best qualified to pass on such judgments. It is his privilege to refuse but he will be more valuable to the group when he takes an active part in such matters.

SELECTION

Men who enter aviation because of the extra pay or for reasons other than the simple desire to fly are usually a constant source of trouble. A few experiences with this type of person forcibly demonstrates the importance of careful selection. The great gain afforded by excluding even one such individual is worth the many extra hours spent by selection boards.

The very best pilots are those who are devoted to flying. They are usually successful even though they lack the technical skill of the one who possesses natural ability. Some of these men are real fighters, who simply like to fight and get real enjoyment out of pressing an attack to a dangerous extreme. Others are those who want to do their job well, have chosen flying with the full realization of what it will eventually lead to, and feel that they have an obligation to fulfill.

Likewise, selection must carefully eliminate all individuals with a psychopathic nature whose record of accomplishments, interests, and reaction to unpleasant situations indicates that they will fail when faced with the realities of combat. A very detailed personal history must be obtained because too often the person disguises his real motivations in order to pass the examination.

MENTAL PROPHYLAXIS

It is now generally agreed that a certain amount of mental prophylaxis against emotional disorders can be obtained by tactful indoctrination of the pilot in the psychology of fear. A series of lectures given in simple terms and in a friendly manner will do much to dispel the uncertainties of combat. Although the average person resents the discussion of mental problems, aviators will wel-

come this type of information if given to them just prior to their first strike.

Such a lecture should start with a careful, simple explanation of fear and the meaning of the many physiological changes every airman has noticed in his own body—dryness of the mouth, rapid pulse, tension, and a strong desire to run away. Careful distinction should be made between fear and cowardice since most men confuse these terms. They must be made to understand that fear is normal, common to all men, and that rather than being harmful is very useful in preparing the body for combat provided it can be properly subjugated.

For those pilots entering combat for the first time, the fight to suppress fear is the biggest battle of their lives. They are anxious to acquit themselves well and are worried that they might become afraid and run away. A brief discussion of the origin of tension, anxiety, and combat fatigue is valuable but it is unwise to proceed far in this field because of the danger of individual scrutiny of self and comrades. Knowledge in this respect is not always wholesome.

Some medical officers like to include an informal discussion on why we are fighting—freedom of the press, speech, rights of citizenship, etc. Entry into this sort of discussion must be made with considerable tact, since most aviators, although young, are independent, educated, and have reached their own decisions in this field of thought.

MORALE

If for no other reason, morale is difficult to discuss because it is difficult to define. In regard to carrier air groups it would be best to say that morale is the thread of determination that drives the group to fly hard and fight aggressively. Although it is a frequent subject of conversation in the ready room, few pilots show any evidence of real insight into its nature and certainly no leader can stand before the group and demand that his men have it. And yet, aboard a ship at sea, it is the one most important quality that makes an air group coordinated and efficient.

The medical officer has an important role in the maintenance and promotion of morale and it is his duty to measure its titer from time to time and assure himself that everything possible is being done to maintain it at a high level. He is in an ideal position to do this because he knows each man intimately through living with him, eating at his table and flying with him. He knows each individual's particular behavior pattern and can unconsciously predict his reactions to various situations.

Most naval aviators are quite impressionable and can be moulded to some extent. They lead a hazardous, uncertain existence, crowded

into the confines of a ship at sea. A few well-chosen words here and there can do much to keep them on the right path. It is no overnight task but a real job which demands a little tact, a sense of fairness, and a large portion of common sense.

The material comforts of life—good food, clean quarters, showers, athletics, etc.—while adjuncts to a general sense of well-being are not the basic supporting factors of morale. More important are those which directly concern the status of a man's personal security. The potent factors that affected morale in the early phase of the war no longer exist. There was a time when insufficiently trained pilots had to fight a numerically superior enemy in aircraft that were definitely inferior. The quality of our naval aircraft is now the highest in the world, certainly superior to anything the enemy can offer. Our pilots are well-trained. Furthermore, a definite system of rotation has been established which insures relief of aviation personnel flying in combat. Finally, most groups are successful in combat and they know that in this phase of the war, they are on the winning team and that final victory is only a question of time.

Loss of personnel ranked as the most damaging factor to morale, particularly when the missing pilots were "old hands" and when more than one was lost in a single flight. Most of them maintain the philosophy that "it can't happen to me" and when someone very close to them fails to return from a strike they feel that maybe it can happen. Actually, loss of close personal friends had a more profound effect than enemy gunfire and the fear of death.

The recovery of pilots down at sea did much to sustain morale. The efficiency of the air-sea rescue system was of such high caliber that every pilot firmly believed he would be recovered if forced down near the target. Much credit must be given to Pacific Fleet units for their efforts to recover personnel, often under the very guns of the enemy. To those in command, the recovery of even a single individual was worth the effort of entire naval units. The effect of this on the average pilot has been tremendous, and the feeling that he, as an individual, is worth saving has done more to bolster his fighting spirit and general aggressiveness than any other factor.

LEADERSHIP

The tolerance of men for long-continued strain of combat is somewhat dependent on the caliber of their leaders. A weak individual associates himself with the group as a whole, his own short-comings being compensated for by the ability of the others. If the group has been generally successful and is led by a strong leader, the weaker members will be carried along for some time. Although there is a similarity between military and civilian leadership, and between leadership in various military organizations, it exists in a very pure

form in carrier aviation. The men live close together and by their occupation are somewhat high strung and temperamental. The average carrier pilot is about 23 years old, not yet accustomed to military regimentation, and does not respond to coarse treatment. They require a leader who holds their respect and confidence and who is completely accessible to them.

They are not adaptable to the blind obedience demanded by a martinet and resent the order to do something without explanation. These men are highly independent, capable of much individual initiative, and part of an expensively trained group, the effective action of which is interdependent on each person in the squadron. They are willing to submit to authority when they know the need for it.

Some qualities of leadership are acquired through training, others only through experience, still others are a part of a man's natural endowment at birth and for that reason, if for no other, not all of us can be leaders of men. A man may be blessed with great powers of reasoning or a remarkable skill but if he lacks certain qualities, these other attributes are almost useless. Every pilot looks to the leader for guidance until he shows that his guidance is unreliable. All his words and actions influence those who fly with him, either for good or for bad.

From the very first day, he must prove to them that he is an expert flyer with a wide knowledge of tactics, gunnery, and aircraft. He must have absolute control of his emotions because outbursts of anger and irritation can, in a few minutes' time, break down respect that required weeks and months to accumulate. If he shows that he is flustered and worried during ordinary administrative emergencies, he cannot expect his men to believe that he will be otherwise in battle. Such outbursts induce fear in some pilots and anger in others. Both of these are strong emotions and can interfere with the coordination required in flying. It seems, however, that a calm equanimity is an endowment that many of us do not have and cannot even obtain through self-education.

It has been said that many a successful military leader has been hated by his men. Although this might be true in regard to large groups of men and armies, it is doubtful if a hated squadron commander living with his men on board a ship will attain much success. Personal popularity is very desirable and despite opinion to the contrary, can be attained without incurring disrespect. A natural friendliness and a tendency to decline the privileges due his rank and position are important qualities.

Pilots like to think of their skipper as a loyal person who is doing as much as possible for them, particularly in regard to their safety in flying; a man who will "really go to bat for a guy." In doing this,

he shows his broadness of mind by standing behind even the less desirable officers when they are in trouble.

When a man assumes command of a group of young fliers, he has undertaken one of the most difficult tasks in aviation. Criticism leveled at him should be somewhat cautious. He will make errors from time to time and aviators expect that. They also expect him to quickly admit an error, to correct it, and to learn from it.

Few men have all the attributes of a leader. But if he is a good flyer, can maintain a calm, impassive manner, be a good fellow, and, to use Osler's admonition to a physician, "practice with his heart as well as with his hand," he will have his men behind him on every strike.



SOME INTERRELATIONSHIPS OF DIETARY IRON, COPPER, AND COBALT IN METABOLISM

Authors' summary.—Five diets of varying ratios of iron, copper, and cobalt were fed to young healthy albino rats and the effect of the three metals on food intake, growth, hemoglobin level, and metal storage and retention determined. The results were as follows:

1. Low levels of iron or copper decreased food intake, growth and hemoglobin level, but 0.003 p. p. m. to 0.08 p. p. m. of cobalt in the diet showed no difference in these responses.

2. Tentatively, cobalt retention, at levels characteristic of the food supply, was calculated. Cobalt retention on low cobalt diets (0.003 p. p. m. cobalt) was 30 to 42%, while retention on high cobalt diets (0.08 p. p. m. cobalt) was 3.3 to 4.9%.

3. The cobalt content per gm. of fresh rat carcass varied with the diet, age and sex of the animals.

4. Iron and copper did not affect cobalt retention nor cobalt markedly iron and copper retention.

5. The iron and copper in the basal milk diet were relatively poorly utilized by the rat. Added copper doubled this iron retention, while added iron had only a small or insignificant effect on this copper retention, within the range of iron used in these experiments.

6. The body conserved its iron with relatively greater efficiency than its copper.

7. While anemic animals retain more metal than normal animals on the same diet, a normal animal becoming anemic on a copper-low diet retains less copper than a litter mate in better condition on a good copper diet.—HOUK, A. E. H., THOMAS, A. W., and SHERMAN, H. C.: Some interrelationships of dietary iron, copper, and cobalt in metabolism. *J. Nutrition* 31: 609-620, May 1946.

REPAIR OF SOFT TISSUE DEFECTS OF THE FOOT

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Injuries involving loss of tissue of the sole of the foot might at times be extensive and often present great problems in their reconstruction for the military surgeon. It is usually impossible and rarely successful to repair even small losses by pulling the skin edges together with sutures. Wounds of the sole sutured under tension almost invariably will not hold, although occasionally small lesions not over the most prominent weight-bearing surfaces may be excised and sutured. Not only is the skin highly specialized but of equal importance is the subcutaneous fat pad—a similar structure being present in no other place on the body. The loss of the fat pad, then, is of serious consequence and its replacement with fat from any other source is at best a makeshift. Frequently, small losses may be replaced by transferring pedicle grafts from some area that is not as much concerned with weight bearing and the necessary associated trauma, such as that just proximal to the base of the toes or under the instep. More often, however, the loss is extensive and requires a pedicle graft transferred from a distance for its repair.

A frequent condition seen in the service is the simple plantar wart which, if neglected or injudiciously treated, may completely incapacitate the patient. We will not open the question of the best method of treating these lesions in an early stage. Often they are cured completely and satisfactorily in one of a number of ways. Rather, we consider the following case as an example of one that had been treated unsuccessfully.

Case 1.—The patient had been totally incapacitated for 8 months because of a small plantar wart which he had had excised on two occasions, curetted once, cauterized once, and when he reported here, presented a painful ulcer, infected and with so much surrounding scarring that there was transverse contracture of his foot sufficient to draw his second and fourth toes together with the third toe overriding (fig. 1). The patient could hobble around on his heel



FIGURE 1.—Preoperative view of plantar wart.



FIGURE 2.—Postoperative view of plantar wart.

but could not bear his weight. As in many cases, his wart was gone, but he was left with a loss of tissue from the sole of his foot, slight it is true, but sufficient to render him unfit for duty and to necessitate his return from the Pacific at a time when his services were urgently needed there.

The condition was relieved by excising the ulcer and surrounding scar and covering the defect with a pedicle graft from the base of the toes. The bed of the pedicle graft was covered with a split thickness skin graft and the patient has been comfortable ever since (fig. 2).

It is sometimes possible to resurface a superficial loss with a thick-split thickness skin graft where the fat pad is intact or over an area that is not subject to excessive trauma incident to weight bearing.

Case 2.—A large papilloma was located on the medial side of the heel. In this case it was possible to excise the tumor and resurface the defect with a thick-split thickness skin graft.

On occasions we have applied thick-split thickness skin grafts directly over weight-bearing surfaces, such as under the heel or ball of the foot, but only if there has been a superficial loss of the covering skin with the fat pad intact. Occasionally it is possible to use a flap from underneath the instep and cover the donor area with a split-skin graft, but it is not practicable to resurface extensive losses in this manner.

In replacing tissue loss on the foot where the loss is extensive and too large to be corrected by a local transfer of a pedicle graft, it is necessary to utilize tissue from a more distant donor area, and the procedure becomes more complicated and often requires a series of operative steps. It must be remembered that there is no 100 percent satisfactory tissue which can be used as replacement for loss of the sole, but with careful planning and execution it is possible to make acceptable restorations. An adequate donor site is one which will yield skin and a sufficient padding of subcutaneous fat as to result in a good soft pad which will bear the patient's weight comfortably and also stand the pressure of his shoe. The most satisfactory and most convenient site for obtaining this tissue is from the opposite uninjured extremity. It can be obtained from either the thigh or the calf of the leg, but we have found the latter to be preferable because it is more comfortable to the patient. However, with female patients the thigh is used because they almost invariably prefer a few weeks of discomfort rather than a permanent deformity of the calf.

Having decided upon the donor site, the patient is carefully examined to determine what will be the most comfortable position for him while the flap is being transferred. Careful measurements are made to insure that the flap will be adequate in size and have a sufficiently long pedicle. It is wise to make the flap a little larger than the actual measurements indicate since it must be remembered that the defect is apt to increase in size after the excision of the involved scar. Pedicle grafts should be planned with special consideration of the direction of the blood supply, although one should also consider the venous and lymphatic drainage as well. In other words, if possible, the base of the pedicle graft should be proximal to and in line with the direction of the blood vessels that will supply it. The contemplated flap is marked out over the donor area with methylene blue or some other dye and, if it is not too large, it may be raised and transferred in one operation.

Case 3.—This patient sustained a stone bruise over the weight-bearing surface of his heel with a resultant ulcer. The lesion was about the size of a 50-cent piece. The base of the ulcer extended down to and involved the plantar fascia. It was possible to excise the ulcer and cover the defect with a pedicle graft from the opposite leg all in one stage. A free split thickness skin graft was used to cover the pedicle bed (figs. 3, 4, and 5).

In larger flaps, however, it is wise to elevate the skin and fat through two parallel incisions at the borders, clamp and tie the bleeders, and suture the flap back into its original bed. After a period of 10 to 14 days the tip of the flap is cut across and sutured back, and after 2 more weeks, if the circulation in the flap seems adequate, it is raised again and transferred to the defect.

When the pedicle graft is raised, the recipient area is prepared by ex-



FIGURE 3.—Preoperative view.



FIGURE 4.—Postoperative view.

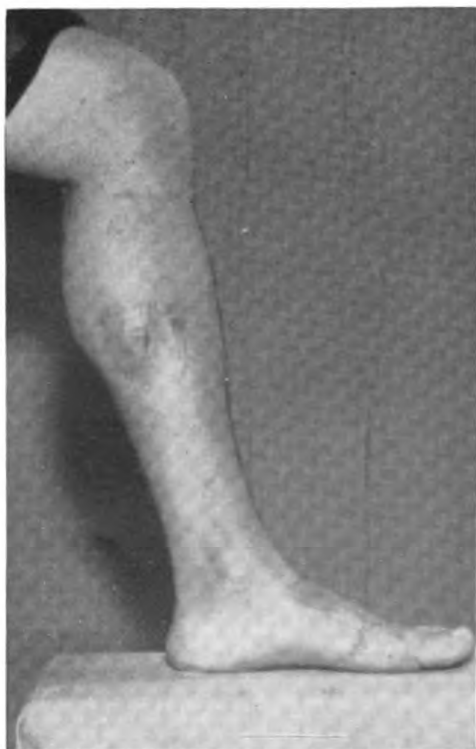


FIGURE 5.—Postoperative view of donor site.

cising the scar borders of the defect and the granulations down to the scar base, avoiding, if possible, exposing bare bone. If, however, bone is involved in the base, the diseased bone must be removed. It saves time and makes postoperative care easier if the original bed of the pedicle graft is covered with a split-thickness skin graft before the two extremities are joined, in other words, dressing the donor area with a skin graft. Then, with assistants holding the two extremities in proper position, the flap is carefully sutured over the defect and a plaster cast applied to maintain this position until sufficient blood supply has developed to maintain viability of the transposed flap after the pedicle is severed.



FIGURE 6.—Preoperative view.



FIGURE 7.—Pedicle divided but unrevised.

Case 4.—This patient sustained an extensive soft tissue loss involving the medial, plantar, and to some extent, the lateral portion of his foot with a compound fracture in an explosion aboard ship. A pedicle graft on the opposite leg was delayed in two stages as described above before it was transferred to the injured foot. It was divided in 4 weeks and revised at subsequent operations (figs. 6, 7, 8, and 9).

In cases where it is necessary to use the pedicle with its base distally, several steps may be required to undermine the flap and cut around its three borders, prior to transferring it—always remembering the importance of having an adequate blood supply. Retrograde flaps seem to be better manipulated when the lesion involves the outer side and the outer portion of the sole of the foot.



FIGURE 8.—Reconstruction completed.

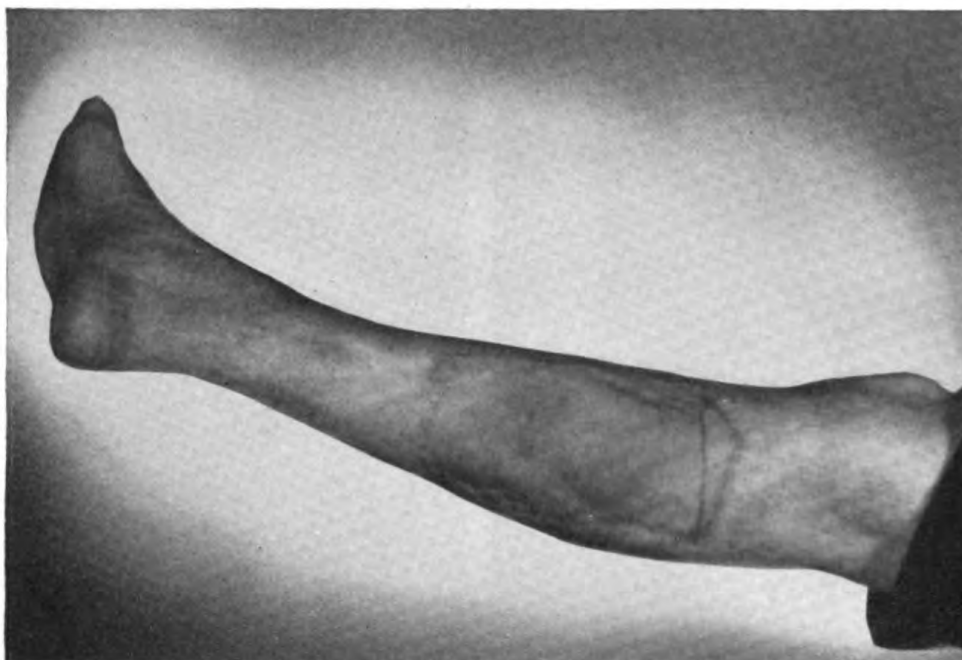


FIGURE 9.—Postoperative view of donor site.

Case 5.—This patient sustained a marked tissue loss involving the outer side of the foot and a portion of the adjacent area of the sole with a compound fracture of the tarsal bones in an injury aboard ship. A retrograde pedicle graft was delayed on the medial surface of the opposite leg before it was

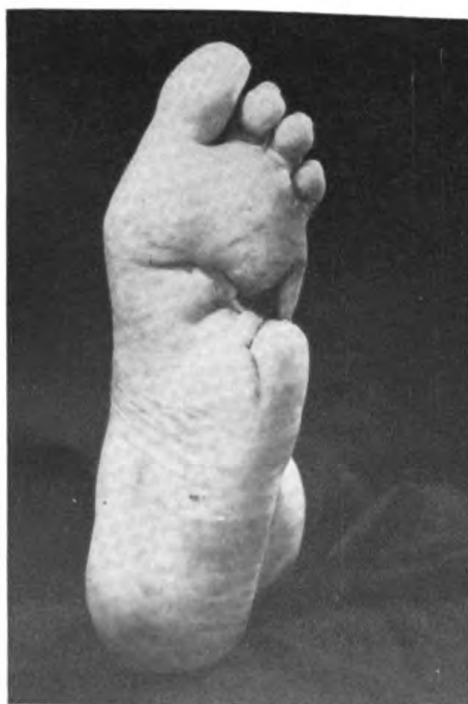


FIGURE 10.—Preoperative view.



FIGURE 11.—Postoperative view.

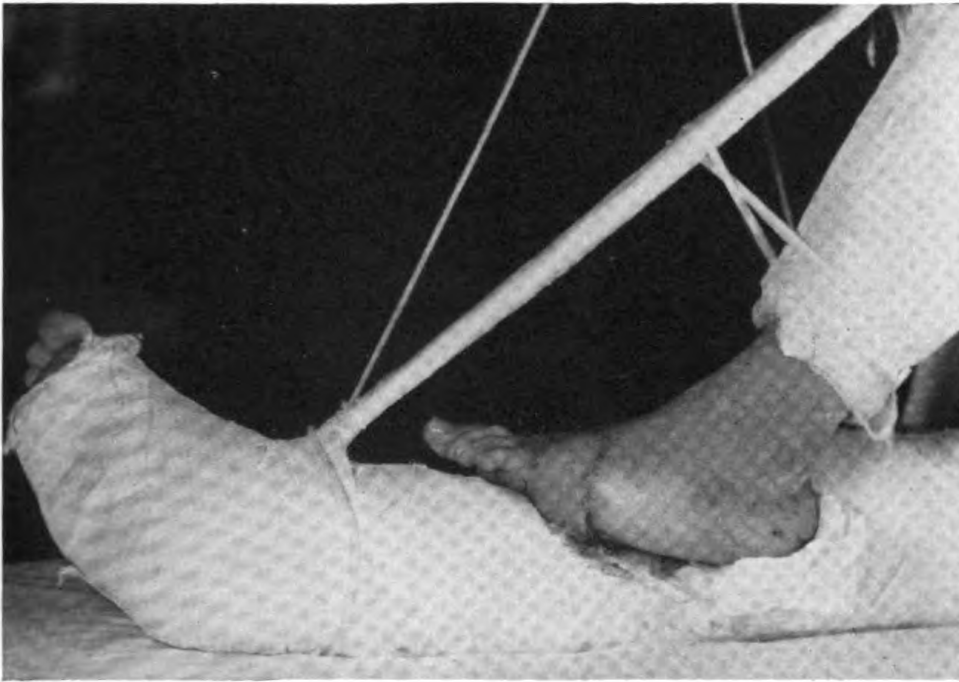


FIGURE 12.—View showing method of fixing leg while pedicle is gaining attachment.

attached to the foot. It was divided in 4 weeks and revised at subsequent operations. A split-thickness skin graft was applied to the pedicle bed (figs. 10, 11, and 12).

In repairing defects over the posterior surface of the os calcis the same procedure is followed as for those involving the sole.

Case 6.—This patient sustained a gunshot wound of the heel with compound fracture of the os calcis. A pedicle graft from the opposite leg was delayed in the manner described above before attaching it to the heel after excision of the ulcer and peripheral scar. It was divided in approximately 3 weeks and revised at subsequent operations (figs. 13 and 14).

The dressings and care of the pedicle graft during the time that the extremities are joined are important and require ingenuity and constant attention. All tension should be kept off the pedicle, and light, firm pressure kept over the attached part of the flap to insure complete apposition of the flap and recipient area, so that no blood or serum can collect underneath the flap. The patient should be examined at frequent intervals to see that there is no tension or twisting or pinching of the base of the pedicle and frequent adjustments should be made if necessary. After 3 to 4 weeks the plaster cast is removed and the pedicle is divided. After a few days of wet saline dressings the wounds are clean enough to make the final revision of the free margins of the pedicle and the series of operations is complete.

Before allowing the patient to wear a shoe and begin weight bearing, we always instruct him as to the care of the graft and the importance

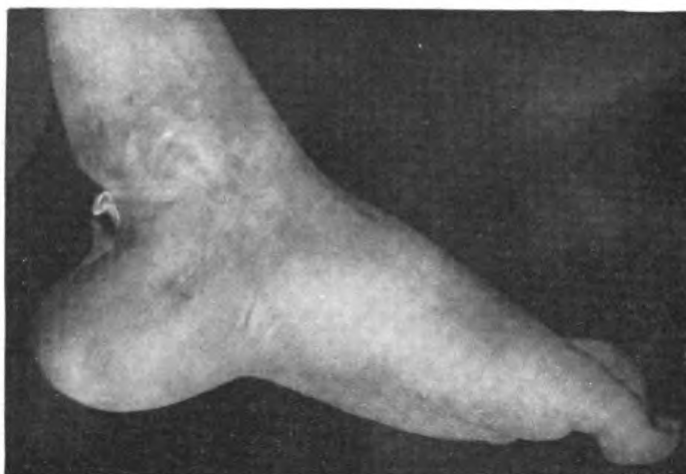


FIGURE 13.—Preoperative view.

of avoiding the development of ulcers or blisters in it. This is especially true for the first few months while the flap is anesthetic. We usually enlist the aid of the orthopedist here to prepare a shoe that is sufficiently padded and constructed to take as much trauma as possible off the flap.

COMMENTS

Men in the armed forces must necessarily spend many hours on their feet and unless they are able to do this, they are not only of little

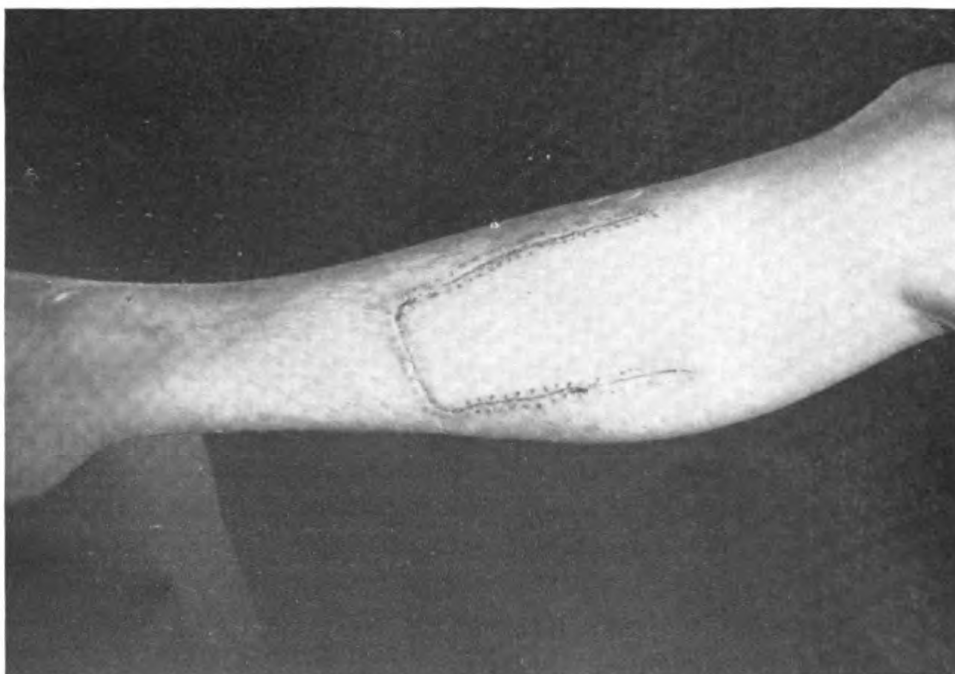


FIGURE 14.—View showing method of pedicle delay on opposite leg.

value to the service but are definite liabilities instead. We well know how annoying even a small pebble or the point of a tack in a shoe can be and how such a seemingly insignificant thing can interfere with our efficiency. It has been brought out that small lesions of the foot may be corrected by transferring pedicle grafts from an area less concerned with weight bearing and the associated trauma, or, in some cases where the loss is superficial and does not include fat, the lesions may be covered with thick-split thickness skin grafts. Extensive lesions of the foot repaired with pedicle grafts from a distance which supply good surface covering and subcutaneous fat in most cases involve extensive operative procedures which are time-consuming and which necessarily subject the patient to discomfort incurred with fixation in a plaster cast while the grafts are gaining attachment. In these cases, results are the most satisfactory and offer the patient tissue replacement which is likely to withstand the trauma incident to weight bearing and shoe pressure.



DENTAL CARIES IN THE COTTON RAT

In a continuation of work on the effect of the diet on the incidence and extent of carious lesions in the cotton rat, the effect of the level of fat and protein and the effect of milk diets have been studied.

Authors' summary.—"1. The isocaloric substitution of 10 or 20 parts of lard for sucrose in a purified ration reduced the incidence and extent of carious lesions in proportion to the amount of lard added.

2. When the casein content of the diet was increased from 24 to 50% at the expense of sucrose, some reduction in caries occurrence was observed.

3. When 50 parts of casein and 10 parts of lard were fed, the protective effect was additive. The number of cavities observed was comparable to that observed when the ration contained 20 parts of lard.

4. No carious lesions were noted when mineralized whole milk diets were fed. The incidence and extent of tooth decay were low when a ration approximating milk solids in composition was fed."—SCHWEIGERT, B. S. SHAW, J. H. ZEPPLIN, M., and ELVEHJEM, C. A.: Dental caries in the cotton rat; effect of amount of protein, fat and carbohydrate in the diet on incidence and extent of carious lesions. *J. Nutrition* 31: 439-447, April 1946.

VITAMIN-DEFICIENCY DISEASES IN ALLIED PRISONERS OF THE JAPANESE

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The writer observed at first hand the rise and fall of dietary fortunes of allied prisoners of war of the Japanese for a period of 3½ years. During this time the majority of known clinical manifestations of the deficiency diseases were observed and treated.

Symptoms varied from the mild dysthesias of beri beri to rapid dramatic death from pellagra. While the deficiency-disease symptoms were ubiquitous and sometimes fatal, it is obvious that the human metabolism can stand a lot of deficiency.

The question of vitamin deficiency developing in a normal person on anything approaching an average American diet now seems ridiculous.

An accurate description of the prisoners' diet would be lengthy since it varied from time to time and place to place. But the general daily diet included about 500 grams of rice, 500 cc. of thin soup of a current vegetable such as squash, sweet potato, onion, bean, corn, turnip, or greens. Meat varied from none for months at a time, to a daily issue of 40 or 50 grams, also for months. Fat was received in amounts only sufficient to flavor the "soup." Salt (NaCl) was available in small amounts about 60 percent of the time. Fruits were obtained in meager amounts in the Philippines. In Japan one man would average about two oranges, one apple, and pear in a year.

The diseases encountered were beri beri, pellagra, xerophthalmia, chelosis, and rarely scurvy.

BERI BERI

It can be safely said that 90 percent of the prisoners had some degree of beri beri at some time during their internment. The most common and least troublesome symptom was a numbness and hyperesthesia of the anterior aspect of the lower extremities. This was often not noticeable to the man unless called to his attention by pricking with a pin. This loss of sensitivity to pain in its extreme form included both upper and lower extremities, abdomen, and face.

One of the most common and miserable complaints, of perhaps doubtful origin but probable B₁ deficiency, was "painful feet" or "elec-

tric feet." These patients complained of sporadic, sharp, lancinating, sensually painful twinges in various parts of the feet (metatarsophalangeal joint regions, metatarsals), inner or outer side of the ankles, and occasionally in the lower leg, hands, or lower arms, accompanied by hyperhidrosis, and distressing burning sensation and hyperesthesia of the skin of the feet. And as these symptoms seemed to be most noticeable at nighttime there was considerable insomnia and subsequent emotional imbalance and distress, which created a vicious cycle, as this emotional disturbance accentuated the subjective symptoms described before. These men developed a characteristic gait, toes pointed outward and each foot carefully lifted up and gingerly set down again, somewhat as though walking on hot rocks. A continuation of this condition often led to a definite ataxia of lower extremities, with a gradually widened gait.

The burning sensation indirectly cost the lives of some and the toes of many more. In vain effort to obtain relief from the distressing sensation of burning feet men would even on the coldest nights in Japan keep their feet out in the cold, soak them in cold water or walk the cold concrete floors. The cold and exposure plus possible vasomotor disturbances combined to produce gangrene of the extremities and eventual loss of toes and parts of feet. A few men with beri beri incarcerated in camp jails for minor offenses suffered similar catastrophes. To the best of my knowledge none of the men in the Tropics with the same complaint of "painful feet" ever developed gangrene and loss of digits at the same time. Ill-advised lumbar sympathectomies performed by unqualified Japanese medical officers against the will of patient and prisoner doctor caused the life of several more of these unfortunate men.

One of the most insidious and disastrous conditions was the development of an optic neuritis which often advanced to atrophy in the absence of treatment or if treatment was instituted too late. Hundreds of men lost vision down to 2/200 in one or both eyes while hundreds more developed varying degrees of lesser defects. Central visual field examinations showed the greatest loss of vision when the macular area was involved. In some cases when the macula was not involved there were only varying sized scotomata. About half of the men with optic neuritis experienced no subjective symptoms along with the failing vision; the other half complained of headaches, pain "behind the eyes," burning of the eyes, difficulty in focusing and judging distance, and rapid fatigue in reading. A small number of eyegrounds examined showed typical redness and haziness of disc margins in active or earlier cases, and disc pallor (especially temporal side) in advanced atrophic cases. The onset was in some cases sudden (24 to 48 hours); in others protracted, taking weeks or months to develop. Therapy

was irregular and rarely adequate and consisted of from 1 to 50 mg. of thiamine hydrochloride daily depending upon availability of the drug. Treatment in some early cases arrested or improved visual defects. When atrophy developed therapy was ineffective. Two patients with optic atrophy, dyesthesias of upper and lower extremities and fifth cranial nerves, and ataxia, also developed partial bilateral deafness presumably due to eighth nerve involvement from B₁ deficiency.

Wet beri beri was extremely common. Symptoms varied from mild recurrent dependent edema to dyspnea, weakness, cardiac collapse, and death. The nature of individual edema was difficult to assess in view of suspected universal hypoproteinemia. No standard of criteria could be developed to differentiate the two forms. Some edemas responded to extra protein in the form of rare (quantitative not qualitative) Red Cross corned beef (4 ounces daily) while others responded to daily thiamine hydrochloride 3 to 5 mg. orally or parenterally. Since the two conditions were usually coexistent, no mistake could be made in the treatment. However, the picture was sometimes confused by the appearance of an occasional nephritis.

Men with borderline beri beri who developed either localized or systemic infection (such as "cold," influenza, pleurisy, pneumonia) commonly experienced a disturbance of water balance resulting in a noticeable edema. Muscular weakness, cramplike pains, and tenderness of the gastrocnemius and soleus muscles were common. This, along with other subjective symptoms, often seemed to appear in the wake of receding edema.

Regarding cardiac complaints, there were frequent nocturnal attacks of alarming shortness of breath. Those who awoke gasping were perhaps fortunate; a good number died in their sleep. Most of those who died suddenly of right-sided heart failure showed the typical post-mortem doll's head cyanosis. Nursing care was wholly inadequate and it was impossible to have men sleep sitting up. Some men with considerable cardiac weakness never reported for treatment (which was often psychotherapeutic only) while others were forced to work although gravely ill. It is not hard to understand how men returned from work and happily died before having to go out to work again the next day.

Precordial "pseudo-angina" was a frequent complaint and about half the time related to what subsequently proved to be serious cardiac weakness. The principal cardiac complaints were edema, shortness of breath, weakness, and occasional stabs of precordial pain unrelated to effort. The main physical findings of beri-beri heart disease were dependent edema, accentuated pulmonic second sound, and sometimes left heart border enlargement to percussion. Also noticed were palpi-

tation, bradycardia followed by tachycardia when failure developed, cardiac irregularities which usually had grave prognostic significance, ascites, and crude evidence of increased venous pressure.

Roughly 75 percent of those with cardiovascular complaints had concurrent neurologic complaints or findings. A minority complained of or showed only cardiovascular symptoms. As a rule there were no cardiac stimulants and almost never enough B₁. Rest when obtainable was the best treatment that could be given. Some recovered spontaneously and some with small amounts of B₁ (1 to 3 mg. daily). Many died.

PELLAGRA

The "Four Horsemen" rode abreast of the famed four D's of pellagra—diarrhea, dermatitis, dementia, and death. From June to December 1942 at the Military Prison Camp at Cabanatuan, P. I., from 30 to 50 men were dying daily from untreated malaria including cerebral form and terminal bacillary and/or amebic dysentery, and starvation. During this period manifestations of pellagra first appeared. In view of the concurrent dysentery and malaria it was sometimes difficult to separate the symptoms of pellagra. A certain number of afebrile patients showing typical skin lesions of pellagra became demented and within several hours lapsed into coma and died. These appeared to be pellagra deaths.

It was impossible to include diarrhea as a deficiency sign in the presence of such widespread bacterial or protozoan dysentery.

The dermatitis on the other hand was clearly and easily recognized. In the Tropics vesiculation followed by superficial ulceration of the extensor surfaces of the lower arms and legs was a little less frequent than the wide, dusky red discoloration or brighter red petechialike figures in the same extensor areas. In temperate zones, there seemed to be a more discreet, superficial, circular reddish-blue lesion from 5 to 10 mm. in diameter distributed over the dorsum of arms, hands, and wrists, and to a lesser extent over the extensor surfaces of the lower legs. These lesions would sometimes ulcerate and heal only after a period of many weeks.

A very common and bothersome complaint was a painful glossitis and stomatitis, which occurred with or without skin lesions. Even bland boiled rice caused pain in eating and was difficult to masticate and swallow. Smoking and the use of condiments, if available, were out of the question. The tongue, buccal mucosa, and lips became extremely tender, red, and swollen in severe cases. Lesser degrees involved tongue and/or buccal mucosa only. As a rule the sides and tip of the tongue were earliest involved and most painful.

Sometimes associated with glossitis or other pellagric skin manifestations but more often alone, was a common and bizarre scrotal complaint. Attention was first called to the condition by an uneasy, burning sensation in the most dependent portion of the scrotum. Examination revealed only a pink or red discoloration of the lower scrotum at first. Widespread development soon ruled out strong soap as a suspected cause. If untreated, a large portion of the skin of the scrotum became discolored, edematous, scaly, and weeping. In men with severe edema from other causes, this scrotitis became serious as a weeping painful secondarily infected lesion.

The skin lesions, glossitis, and scrotitis described responded very well to nicotinic acid when available. The usual oral dose was 100 mg. daily for 10 days.

VITAMIN A DEFICIENCY

Xerophthalmia.—A large number of men had external eye complaints. Early subjective complaint consisted of photophobia, tearing, and burning. Early objective findings consisted only of slight circumcorneal injection, and some palpebral redness. Later, pain, tearing, and photophobia became more intense, and circumcorneal injection increased eventually to diffuse redness of the sclera and the ocular and palpebral conjunctiva. Some blurring of vision was complained of early but was due to nonpurulent ocular discharge. As the condition advanced a 2 to 5 mm. circular, whitish, opaque area developed on some portion of the cornea, usually so placed that all or some portion of the pupil area was covered. Vision was accordingly reduced. Some superficial corneal ulcers appeared with minimal signs and symptoms and developed almost before either doctor or patient was aware of them. These shallow ulcers tended to heal faster and leave less occlusive scars than the ulcers that developed as a whitish plaque with more pronounced symptoms.

A few men developed a panophthalmitis and had the eye surgically removed. Many men had marked loss of vision from occlusive scars over the pupil.

Treatment was inadequate and irregular, and varied from nothing to ½ ounce of cod-liver oil daily. Later, when cases were rare, concentrated vitamin A and D capsules containing 5,000 units of vitamin A were used with success.

An unusual and unexplained phenomenon accounted for from 80 to 90 percent of these corneal ulcers appearing on the left eye.

Other vitamin A deficiencies included night blindness, which was difficult to evaluate, and hyperkeratosis.

SCURVY

Distinctive clinical signs and symptoms of scurvy were surprisingly infrequent. It was not possible to separate the sallow complexion

of scurvy from chronic recurrent malaria with severe secondary anemia. A number of cases of subperiosteal, pretibial hemorrhages were at first mistaken and incised for abscesses. These lesions (4 to 6 cm. in diameter) were painful, fluctuant, and sometimes hot. If left alone they usually were absorbed spontaneously. A number of painful intramuscular hemorrhages in the adductor muscles of the thigh and calf muscles were observed. These, too, usually disappeared if put at rest and left alone. A few became sterile abscesses and responded to incision and drainage. Healing was painful and slow. An occasional, suddenly painful hip, knee, or shoulder joint suggested hemorrhage into the joint space. If death did not intervene, pain continued for days before subsiding. Infrequent nose bleeds, subconjunctival hemorrhages, and ecchymosis were seen. Recession of gums was common and possibly of deficiency origin.

Treatment was effective when citrus fruits became available. Scurvy was undoubtedly a contributory cause of many deaths.

RIBOFLAVIN DEFICIENCY

A fairly frequent superficial erosion or ulceration of the corners of the mouth developed but was never serious or extensive. It was most often seen alone but sometimes associated with a superficial, dry, scaly, erythematous lesion spreading out from the alae of the nose to the cheeks giving the patient a particularly pinched and wizened appearance. The lesion responded to improved food.

MISCELLANEOUS

Several unclassified complaints presented themselves for clinical recognition and treatment. There were frequent outbreaks of boils; carbuncles; deep abscesses of fingers, sole and palm; and multiple superficial axillary abscesses.

One of the most intriguing complaints in the Philippines was the appearance of breast tumors. Men gradually developed these tender, hard, freely movable, discreet, 1 to 2 cm. masses on one or both breasts after 5 or 6 months of imprisonment. They were located immediately below or slightly to one side of the nipple. No significant clinical or historical features attended these cases. Surgical excision was resorted to in a few early cases before the nature of the condition was recognized. At one time there was perhaps a 5 to 6 percent incidence. Most tumors persisted for months; many gradually disappeared with improvement in food.

It is significant to note that there was frequently a direct relationship between chronic diarrhea (from amebic and/or bacillary dysentery) and avitaminosis. Men with more normal gastro-intestinal function developed fewer and milder vitamin deficiencies.

The favorite Japanese custom of frequent searching and confiscation of suspicious papers which included medical notes has made it impossible to present this material in a statistical form. Detailed notes of these observations unhappily lent greater intensity to the brilliant flames of burning Osaka.



TREATMENT OF LUPUS VULGARIS WITH CALCIFEROL

Author's summary.—Thirty-eight cases of lupus vulgaris treated with calciferol by mouth are reviewed. The maximum dose has been 150,000 i.u. daily, this being the highest dose that most patients appear to be able to take without feeling sick; it has been reduced after varying periods to 100,000 or 50,000 i.u. daily. The drug used throughout has been the Glaxo product Ostelin, which is put up in tablets each containing 50,000 i.u. On the dosage prescribed few patients showed any sign of intolerance, and those that did were able to take the lower dose without discomfort. With one exception all have been old cases; many of them had received local treatment chiefly with Finsen or Kromayer light, liquid acid nitrate of mercury, or Eulykol. Most of the oldest cases had been scarred by past X-ray treatment. Some continued to have local treatment in addition to calciferol by mouth.

Of the cases in which it has been possible to assess results, fortunately the majority, all have appeared to improve, though in a few no very striking change has taken place; but in the great majority the lupus has regressed to a remarkable degree, sometimes to the point of disappearance.—DOWLING, G. B., and PROSSER THOMAS, E. W.: Treatment of lupus vulgaris with calciferol. Brit. J. Dermat. 58: 45-52, March-April 1946.

SUBNORMAL INTELLIGENCE IN THE MALADJUSTED NAVAL TRAINEE

Problems in Recognizing Low Intelligence

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One of the chief functions of the neuropsychiatric units at naval training centers is to separate the inapt and maladjusted individual from service as expeditiously as possible. Several articles have been written outlining the programs, problems, and procedures of these units (2) (6) (9). One of the duties of the psychologist at these units is the supervision and administration of psychometric examinations. He thereby becomes acquainted with the situations where low intelligence is associated with maladjustment.

The purpose of the present article is to demonstrate the extent to which subnormal intelligence occurs in the cases considered unsuited for service, and further, to point out the tendency to overlook this factor in populations where it is presumably important.

The most apparent cases where maladjustment is due to intellectual limitations are those of the mental defectives. Although all who are obviously defective are rejected at naval recruiting or induction centers, a certain percentage of less obvious defectives reaches the naval training centers. Of all the recruits discharged from the centers as neuropsychiatrically unfit, the proportion that is definitely feeble-minded is small. The monthly average in recent months of mental defectives at the U. S. Naval Training Center, Sampson, N. Y., has ranged from 3 to 7 percent of those discharged for psychiatric reasons. A comparison of these figures with those obtained earlier in the war suggests that the screening at induction centers and recruiting stations improved. In the early months of 1942 twenty-seven percent of the men discharged from the U. S. Naval Training Station at Newport, R. I., were classed as mental defectives (9). Though these figures are not directly comparable,¹ the trend is apparent.

Now, let the much larger group of cases that are not definitely defective but are of subnormal intelligence be considered. In the writer's

¹ There were slightly different standards in that the Newport figure included some cases with mental ages between 10½ and 11 years. The Sampson figure includes only those with mental ages of 10½ and below.

experience as a psychologist at naval training centers several thousand discharged cases have been reviewed. Certain facts emerging from this experience are: (1) There is an unduly high proportion of cases of subnormal intelligence; (2) there is a widespread failure to recognize the extent to which the factor of low intelligence may be operative in maladjustment; and (3) low intelligence is not readily detected during recruit training. Data supporting these statements is given in the following discussion.

In confirmation of the first point the intelligence levels of 2 groups of discharges have been ascertained, using 2 separate measures of intelligence. The subjects in the first group numbered 101 and represented the complete run of unfit recruits discharged during 6 consecutive sessions of the aptitude board. For this group the Kent Battery was used. This is a brief, individual intelligence test which has had wide use at naval training centers. Its use has been described by Hunt, Lewinski, and others (3) (4) (5). Median mental age on the battery was used as a measure of intelligence level. The results are shown graphically in figure 1. In this figure the distribution of intelligence

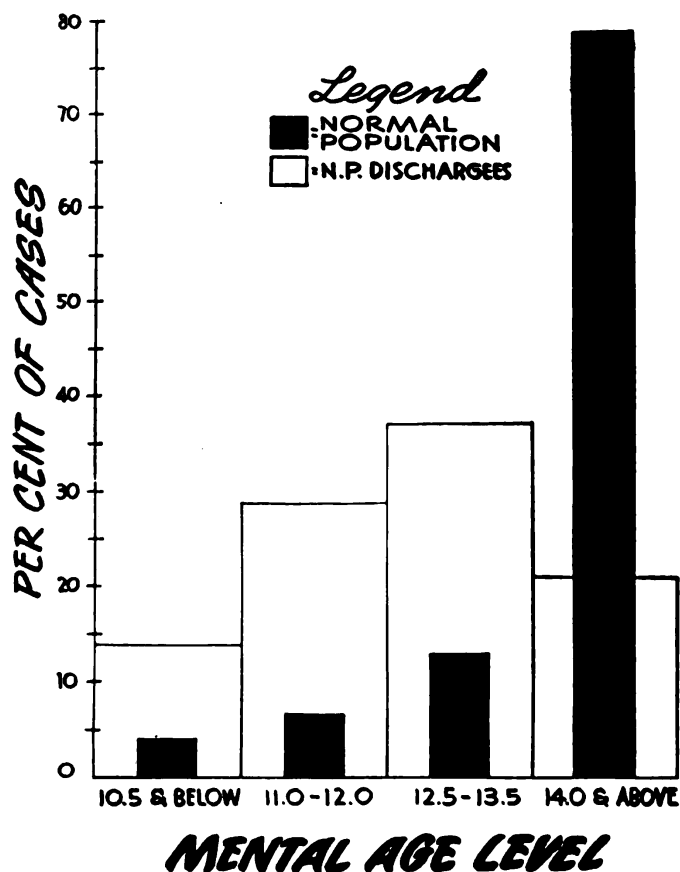


FIGURE 1.

of the experimental group is contrasted with that expected in the normal population. For distribution of intelligence in the normal population, interpolation from the figure given by Wechsler ((7), table 5, page 42) has been made. The validity of this comparison is supported by the study of Lewinski, in which he found a correlation of +0.727 between the Kent and Wechsler Bellevue scales (5). Examination of the figure shows that differences at any mental age level are gross. The neuropsychiatric group has a strikingly high proportion of cases in all of the subnormal groups.

One might assume that if all obvious cases of low intelligence were excluded, neuropsychiatric cases would not show disproportionate weighting in the subnormal levels. To show that even this is not the case, another group was chosen. In this group the General Classification Test scores of 98 unfit recruits who also were given discharges were examined. Only those who had been referred to the neuropsychiatric unit after they had first completed a period of recruit training were considered. It is important to note that all of those who had appeared definitely defective or obviously unfit had previously been eliminated in the receiving-line examination. The General Classification Test is a written intelligence test given to all naval recruits for purposes of classification. The test is scored so that the average score in the normal recruit population is 50. The standard deviation is 10. The average score for this second group of discharges was 46. While the difference between this and the average recruit score is not as marked as differences shown by the first group, yet nevertheless the difference is statistically significant. The critical ratio of the difference between the scores of the selected group and the scores expected from the normal recruit population is 3.78. In examining the distribution of scores it was found that over 50 percent of the group made scores of 45 or below. This group comparison would show that even after the brief psychiatric screening had eliminated the most obviously unfit, the group of neuropsychiatric discharges scores lower on intelligence tests than the normal recruit population.

Additional evidence of low intelligence as a factor in maladjustment can be cited from other sources. Some results obtained by the Special Tests Division of the Classification Department at one training center (1) are briefly summarized next. This office set up a psychological clinic to improve the placement of men in service. Individuals failing to adjust were referred to this clinic from various activities at the center and the most severely maladjusted cases in turn were referred to the neuropsychiatric unit for examination. Of those referred to that unit and subsequently discharged, two-thirds had made marks of 32 or below on the General Classification Test. In all, 95 per-

cent of this low General Classification Test group were of subnormal intelligence.

Interviewing the recruits making low marks on the General Classification Test has been found to be a valuable supplement to the psychiatric screening procedures. In recent months at this center the Classification Department has administered a written personality inventory to the lowest scoring group on the General Classification Test. Cases indicating either a number of somatic complaints or a single symptom (such as enuresis) considered significant by naval criteria are referred to the neuropsychiatric unit. Approximately two-thirds of those referred are found to be definitely unsuited for service. It is of interest to compare this figure with that obtained from the group of men placed on trial duty following the initial psychiatric interview. At the screening interview individuals having complaints of a psychosomatic nature are placed on trial duty and are subsequently interviewed. In comparing this group with the low General Classification Test group over a period of several months a higher proportion of the low General Classification Test group was found to be unfit. One of the principal differences in the two groups was that the low General Classification Test group contained for the most part subjects of subnormal intelligence.

These results show that the neuropsychiatric discharges as a group are of lower intelligence than the normal population, but further analysis is needed to demonstrate the type of cases that is responsible for this difference. As stated elsewhere, the purpose of the examination at the psychiatric unit is to determine whether or not the individuals concerned are suitable for naval service. In some instances, cases may be discharged where unsuitability is demonstrated, yet a psychiatric diagnosis is not established. Analysis of these cases is nevertheless fruitful as the reasons given for discharge represent the cumulative opinion of two or three psychiatrists, along with supportive material such as psychologic tests, social history, and company commanders' reports. Of all neuropsychiatric discharges the largest group by far is that termed personality disorder, in which the primary feature is inadequate personality. Psychiatrists most frequently term such cases as generally inadequate. Frequently allied to this descriptive term are those of emotional instability and emotional immaturity, dullness, little drive, nostalgia, and poor integration. In the majority of such cases there were a number of somatic complaints for which no organic basis has been found. These complaints may be of recent origin and may have been precipitated by separation from the home environment. The part of the body to which these complaints are referable is usually one in which the subject had experienced minor distress previously. Concomitant with the other spheres of inadequacy exhibited, there is often poor motivation for the service.

If the groups which were tested are considered and analyzed in terms of diagnosis or reason for referral, certain relationships between intelligence and diagnosis are readily apparent. Of the group that had been termed inadequate personality practically all had subnormal intelligence. In the majority of cases the diagnosis was established independently without knowledge of psychometric results. Of the cases diagnosed psychoneurotic, the majority had normal or superior intelligence. To illustrate this relationship the diagnoses in portions of the General Classification Test group previously mentioned might be analyzed and those that made scores of 60 or above compared with those making marks of 40 or below. (To clarify the comparison cases of neurological disorder, epilepsy, migraine, and schizoid individuals, as well as one mental defective, were eliminated.) In the high group, 80 percent of the cases was considered neurotic or reported to have anxiety states. One was discharged because of a personality disorder, emotional instability. None in the group was labeled as an inadequate personality. In the group making marks of 40 or below, 21 of 24 cases were termed personality disorder and 3 were classed as psychoneurotic. Of the 21 personality disorders, 17 (or 81 percent) were considered as inadequate, 3 as emotionally unstable, and in one case it was not certain whether schizoid features or those of inadequacy were more important. Of the 3 neurotics in the low group, 2 were cases of conversion hysteria.

The foregoing discussion might be summarized by stating that two separate measures of intelligence show a heavy weighting of neuropsychiatric discharges in the dull intelligence group. The majority of such cases fit into a category described as inadequate personality.

If low intelligence is an attribute of such a large number of cases unsuited for service, then one might assume that it is a factor which could easily be recognized by those without special training. This is not so.

The question of whether or not a recruit is making a good adjustment in training is frequently referred to his company commander. The company commander supervises and observes the recruit from the beginning of training through graduation. He observes him in all phases of his training activities. Replies to questionnaires about individuals on trial duty status from the neuropsychiatric units are given by the company commander. Most training centers have made extensive use of such questionnaires. The questionnaire used at this center refers to two aspects of behavior which were considered to serve as indicators of subnormal intelligence. One question is: "Does he learn easily?" The answer to this question for men who had made below 32 on the General Classification Test has been analyzed. In a group of 547 cases making below 32 in the General Classification Test,

only 121 or 22 percent were noted as not learning easily. Yet a separate study (1) has shown that 95 percent of those making such scores were below the range of normal intelligence. As regards the second aspect of behavior in the same group only 22 percent was noted as being awkward in drill.

Learning ability generally has been found to correlate highly with intelligence test scores. Many studies upon this relationship have been made and, indeed, in defining the concept of intelligence many use learning as one basic part of their concept. However, it was observed here that there was little relationship between the judgments of learning in recruit training and intelligence test scores. Company commanders' reports were analyzed for a group of 888 cases which were referred to the psychologist for psychometric study. The Kent median mental age was obtained. The group was composed of men making below 32 on the General Classification Test so that practically all of the distribution falls below the average intelligence range. (The mental-age range was from 9 years to 14 years, and the mean mental age for the distribution was 10.7.) The correlation (bis. r) between reports of learning and intelligence was $.020 \pm .030$. Statistically there was no significant relationship between reports of learning and intelligence. This corresponds closely to the findings of Wheeler et al. (8) in which a bis. r of $.09 \pm .04$ was obtained for a similar group.

It might also be expected that reports of awkwardness in drill in a group of subnormal intelligence would show some relationship to intelligence test scores. However, in a similar group of 918, the correlation (bis. r) between Kent mental age and the report of "not awkward in drill" was $.067 \pm .030$. (Mental age range 9 to 14 years and mean mental age 10.7). Once again there was no significant correlation between intelligence test scores and reports of awkwardness.

In an effort to determine more exactly the conditions under which a recruit was observed, all company commanders in one regiment were interviewed. In the interview the following questions concerning the replies made to the questionnaire were presented: (1) Whether or not the reports were based upon first-hand observation of the men in question; (2) in what situations were their observations most frequently made; and (3) what aspects of a recruit's behavior determined their decisions as to his learning ability?

In regard to the first question the majority stated their reports were based upon first-hand impressions or else these impressions were supported by those of the assistant company commander. As to the second question, the majority stated that the principal situation in which observations were made was on the drill field. Other situations frequently named were conduct on work details, in the classrooms, and while on guard duty. Answers to the third question are related closely

to the second. Since most observations were made upon behavior on the drill field, the most frequent signs of learning difficulties were slowness or failures to properly carry out the orders given. Other characteristics of a recruit's behavior frequently cited as determinors in judgments were the type of questions asked, whether or not he kept his gear in an orderly manner, and his personal neatness and military bearing.

Certain conclusions may be made in regard to judgments of a recruit's learning ability: (1) Most reports are based on observation of the recruit on the drill field; (2) observed slowness and failures in executing commands given on the drill field were not related to intelligence in the group studied; and (3) if an individual of subnormal intelligence is alert, of neat appearance, and if he does not expose his intellectual limitations by asking questions, his low intelligence will most probably not be detected while in training.

A general failure to note deficiencies in intelligence is also shown by various staff officers who refer recruits for examination. Aside from those recruits noted in the psychiatric screening interview, the second most common source of referral is from the medical dispensaries. Analysis of the examining psychiatrist's reports on referral sheets shows that the majority of inadequate individuals of subnormal intelligence are referred because of persistent somatic complaints for which no organic basis has been found. In the group that is of subnormal intelligence it is relatively rare that deficiencies in this part of the individual's personality are noted. The same statement holds true in regard to those referred by chaplains and other officers.

SUMMARY

An unduly high proportion of subnormal intelligence is found among the maladjusted recruits who are subsequently discharged from service for neuropsychiatric reasons. This is true even when mental defectives are excluded. Two group studies are reported in which the greater incidence of low intelligence among discharges is shown. Other evidence corroborating these studies is also given. Cases accounting for the increased weighting at subnormal levels are most frequently termed inadequate personalities and low intelligence therefore appears to be one of the more constant attributes of such cases.

Even though low intelligence would seem to be an important factor in adjustment failures, it is seldom recognized. When inadequates of subnormal intelligence are referred to the neuropsychiatric unit, the factor of low intelligence is not often noted. Also, in a group of cases where 95 percent was of subnormal intelligence, only 22 percent was noted as learning slowly by the company commanders. If low

intelligence could be recognized with any degree of accuracy one might expect some correlation between reports of recruits' learning and intelligence. However, analysis of a large number of cases shows that there is no significant relationship between reports made of learning in recruit training and intelligence.

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SYMPTOMS AND MANAGEMENT OF ARTERIAL HYPERTENSION AMONG NAVAL PERSONNEL ¹

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Arterial hypertension is at present the major cause of mortality in this country and has the highest disability rate of any illness in the age period of 25 to 64 years (8). According to the statistics of the Metropolitan Life Insurance Co., 50 percent of the deaths among members of the population of the United States past the age of 50 years are from cardiorenal vascular disease.

DATA ON NORMAL AND ABNORMAL BLOOD PRESSURE

When confronted with questions concerning blood pressure it is well to recall that the systolic pressure reflects the strength and stroke volume of the left ventricle of the heart, whereas the diastolic pressure represents the constant load imposed on the walls of the arterial system and gives an indication of the degree of peripheral resistance. A high diastolic pressure, therefore, is often of greater significance than a high systolic pressure. The blood pressure of any normal person is subject to considerable variation, the systolic more than the diastolic. Both are usually higher in the upright than in the recumbent position. Changes occur normally in response to such everyday factors as exertion, digestion, emotion, excitement, pain, excessive heat, and excessive humidity. It is a common experience for physicians to examine patients whose blood pressure falls successively at each of a number of readings made a few minutes apart.

It has been the custom to regard transient elevations of blood pressure as of little significance. However, Hines (2) recently stated that any transient elevation of the systolic and diastolic blood pressure above a certain level should be regarded as evidence of a hyperreactive regulating mechanism for blood pressure and that in many instances this hyperreactivity is a precursor of sustained hypertension. He studied the records of 1,522 patients who returned 10 or 20 years after their first examination, for re-examination at the Mayo Clinic.

¹ Received for publication 6 November 1945.

Blood-pressure readings on re-examination revealed that the higher the first (original) reading of blood pressure at the time of the first examination, the higher the incidence of subsequent hypertension. The incidence of subsequent hypertension when the diastolic reading was less than 85 mm. at the time of the first examination was small. When both the systolic and the diastolic readings were high, the incidence of subsequent hypertension was high. It was interesting that of the group of his patients who had systolic blood pressures of more than 140 mm. on first examination but diastolic blood pressures of less than 85 mm., none had subsequent hypertension. Hines and others have felt that this first blood pressure reading represented the individual's vasomotor reaction to nervous tension and was in effect a psychic pressor test.

In the past, blood pressures of 150 mm. systolic and 100 diastolic were considered the lower limit for hypertension. Insurance mortality studies, however, have indicated that this limit was too high and some authorities now set the limit of beginning hypertension as low as 140 mm. systolic and 90 mm. diastolic.

Definition of hypertension as a cause for rejection for armed forces.—The medical department of the U. S. Navy, has given hypertension—evidenced by persistent systolic blood pressure of more than 150, or in persons less than 25 years of age, a persistent systolic blood pressure of more than 140 or a persistent diastolic pressure of 95 or more before or after exercise—as a cause for rejection of applicants for enlistment. It has ruled that no applicant should be rejected as a result of a single reading. When estimation of blood pressure at the first examination is regarded as abnormal, or in case of doubt, the procedure is to be repeated twice daily (in the morning and in the afternoon) for a sufficient number of days to enable the examiner to arrive at a definite conclusion (9).

Approximately the same standards were prescribed in the Mobilization Regulations issued by the War Department in October 1942, and also in the standards for physical examination for commission in the regular Army.

INCIDENCE OF HYPERTENSION

According to the 1938-39 National Health Survey, 3.5 percent of the total population of the United States suffers from high blood pressure and arteriosclerosis (1). During 1 month at the office of Naval Officer Procurement in Boston, it was observed that 14 percent of young male applicants had mild variable hypertension at the initial examination (7). The frequency with which transient hypertension is first noted has been reported to increase with age (3).

Reed and Love (5) in their biometric studies of Army officers noted that 11.4 percent of officers who were active at the age of 46 years, subsequently had cardiorenal vascular disease.

Master (4) obtained readings of blood pressure on 15,000 men and women of middle age or older. This study indicated that a little more than one-fourth of the men 40 to 49 years of age, a little more than two-fifths of those 50 to 59 years of age, and considerably more than one-half at 60 to 69 years of age had blood pressure of 150 mm. of mercury or more systolic and 90 mm. or more diastolic. A considerably higher percentage of women had readings of this height.

When blood pressures of 140 mm. systolic and 90 mm. diastolic or more were considered to indicate hypertension, the incidence was still higher. About one-third of the men between 40 and 49 years of age had hypertension, approximately one-half between 50 and 59 years of age, and two-thirds in the age group 60 to 69 years. Again the frequency among women was considerably higher than among men. This study reveals also that hypertension of slight or moderate degree is common in persons over the age of 40 years.

ETIOLOGY

Hypertension may be classified into two general types, secondary and primary. Secondary hypertension results from known diseases. It is estimated that 15 percent of all cases of hypertension are of this type.

Most cases (85 percent) of hypertension are of the type designated as "primary," "essential," or "arterial"; that is, the increase in blood pressure cannot be attributed to any known disease.

I think that it is important to appreciate that arterial or essential hypertension is not a disease entity but a bodily state of multiple etiology. The term "arterial hypertension" is used only because this important aspect of the circulation can be measured conveniently.

GROUPS STUDIED

The records of 50 ambulant patients admitted to a naval hospital on the mainland in 1944 with a diagnosis of arterial hypertension were selected at random and reviewed. All were enlisted men or officers, in the combat age group. Some patients had been hospitalized for observation when they had been found to have hypertension at the blood donor centers. Some were transferred to the hospital because of some disorder not related to the circulatory or renal systems. The patients as a rule were free from the late and disabling complications of hypertension. The blood pressure of 40 of these patients was recorded as being more than 150 mm. systolic and 95 mm. diastolic

on admission. Ten had normal blood pressure on admission according to the afore-mentioned standards of the medical department of the United States Navy.

In order to determine the final disposition in cases of hypertension, the records of the 206 patients admitted to the same naval hospital with a diagnosis of arterial hypertension, from 1 January to 31 August 1944, were reviewed for this point. In addition to the 206 cases just mentioned and the 50 afore-mentioned cases in which symptoms were studied, 5 illustrative cases were selected. These are reported in some detail herein.

TABLE 1.—*Symptoms in 50 cases of hypertension*

Symptom*	Number of cases	Percent of 50	Symptom*	Number of cases	Percent of 50
Headache.....	28	56	Insomnia.....	2	4
Dizziness.....	22	44	Edema.....	1	2
Dyspnea.....	19	38	Pressure in head.....	2	4
Nervousness.....	12	24	Loss of memory.....	2	4
Palpitation.....	7	14	Anorexia.....	1	2
Weakness.....	5	10	Nocturia.....	1	2
Somatic aches and pains.....	3	6	Tinnitus.....	1	2
Blurred vision.....	2	4	Precordial pain.....	1	2

*Epistaxis, hot flushes, nausea, vomiting or fainting spells occurred in a few cases.

SYMPTOMS

The symptoms of the 50 patients whose records were studied in detail are listed in order of frequency in table 1. In general they are the same as those reported in other series of cases and are similar to those given every day by new casualties who have essential hypertension.

The symptoms had three general characteristics: (1) They were generally multiple and widespread and involved almost every bodily system; (2) certain symptoms were present in greater frequency; and (3) the duration of symptoms was long.

Headaches were located in the frontal, vertex or occipital regions of the head, or in the back of the neck. The headache was often constant; this constancy indicates nervous or tension headache. If the headache was not constant, the discomfort occurred at any time of day but was noted most frequently in the early morning or evening. The character of the pain varied but it was usually a dull ache.

Dizziness appeared at any time during the day. Vertigo, that is, gross ataxia with imbalance, nausea, and vomiting were rare. Usually the patient described a sense of giddiness or light headedness that varied in degree but was always distressing. It often was associated with sudden change in position. Caloric hearing tests performed in several instances revealed no abnormality although one patient stated

that this test produced the dizziness and other sensations of which he complained. Headaches and dizziness together occurred in 15 of these 50 cases.

The term, "nervousness," was used in the list of symptoms to express anxiety, unhappiness, and a tendency to worry and to become excited over matters of little importance. Patients with such difficulties were frequently introspective, talked long about their complaints, or were emotionally unstable.

The term "weakness" is used to describe increased ease of fatigue or exhaustion. In these cases the sense of weakness or loss of muscular power was usually referred to the extremities. One patient stated that his legs just would not support him. Fatigue of this kind is usually associated with advanced disabling disease. Weakness might appear in the morning after a night's rest, and it frequently disappeared when the patient's mind was diverted with work or play. One man felt less weak after being a prisoner at large.

Dyspnea, which was usually associated with exertion of varying degree, was recorded in 38 percent of the 50 cases. Evidence was not sufficient to justify a diagnosis of myocardial insufficiency in any of these cases.

Palpitation occurred in combination with other cardiac symptoms in 2 cases, with nervousness in 2 and alone in 3. Patients often stated that it came on when they were lying on their left side. It may be secondary to vasomotor changes or an expression of sensitivity of the psyche rather than of myocardial changes. Simple arrhythmias and also premature auricular and ventricular contractions are often observed without evidence of functional impairment of the myocardium.

Dyspnea, palpitation, cardiac pain, and edema are frequently associated in cardiac failure. Twenty-two percent of the patients who had dyspnea did not complain of any of these other three symptoms. There were no complaints of orthopnea, a symptom which is frequent in patients suffering from myocardial damage.

Somatic aches and pains were distressing to the patient and to the physician for no adequate cause was found and no treatment gave more than temporary relief. The pains were hard to describe—a dull ache, numbness, tingling, and a sensation of heaviness. In some cases they were localized to one part, again they migrated or were generalized but they did not have a neurologic distribution. Sometimes the aches were continuous; whether intermittent or constant, they might be worse on rainy days. Sometimes the pain was referred to the region of a joint and a diagnosis of arthritis was made. These vague and yet apparently real complaints appeared to have no common basis. Physiotherapy gave only temporary relief.

Four patients in this group had no symptoms referable to hypertension.

The frequency of symptoms is no indication of the subjective distress of the individual. Epistaxis and fainting were rare complaints yet caused the patients more discomfort and worry than the other symptoms. Aches and pains, dizziness, headaches and insomnia were also troublesome.

The question "Are these symptoms specific for hypertension?" often arises. Riseman and Weiss (6) reported that among patients with normal blood pressure, menopause, obesity, and psychoneurosis produced symptoms similar to those of arterial hypertension.

The symptoms found in cases of hypertension are not due to the increased intra-arterial tension because blood pressure readings as high as 250 mm. systolic have been observed in cases in which no symptoms were present. On the other hand symptoms of hypertension often appear at an early age when blood pressure is either normal or only slightly raised. The height of the blood pressure and the presence of symptoms do not show the degree of correlation expected. Symptoms can often be relieved by suggestion and sedatives.

MANAGEMENT

All physicians have seen patients who must be frightened into being cooperative, but I have observed few of these among service patients who have high blood pressure. Most of them need reassurance.

The patient is blood-pressure conscious and wants to know what his blood-pressure reading is. He wishes for a lower reading, and if it is not forthcoming, he is depressed and worried. If deception is employed, it is unending. An optimistic explanation of as much physiology and pathologic anatomy as the particular patient is capable of understanding helps to reassure him. This is time consuming and sick call seems to last all morning. Furthermore, it requires much insight on the part of the physician. Too long an explanation may over-impress the patient and too short a one will leave him unconvinced. When he knows that no one reading tells the true story, that any one reading is a matter of comparative indifference, and is willing to allow the doctor to use the information for his good, then the blood-pressure reading assumes its proper value.

Most patients believe that high blood pressure carries the ever-present hazard that a blood vessel may burst at any moment. Many of them are reassured when they are told that athletes, who are particularly strong men, raise their pressure excessively whenever they engage in strenuous physical exertion and that their blood vessels do not burst.

Damage to the heart or sudden death from heart disease are other fears. It is important that the patients be told that the early and even the relatively late cardiac changes are limited to hypertrophy, and hypertrophy is nature's answer to work. In moderation it is in no way serious.

The patient can be reassured concerning renal disease since uremia develops in less than 10 percent of the cases of hypertension.

Clinicians must use care concerning the stress which they place on moderate hypertension in order to prevent the development of psychoneurosis or even invalidism. One man in the naval hospital for a broken wrist smiled knowingly when his blood pressure was taken in the course of a routine physical examination. He said, "So you found the high blood pressure too." On questioning he said that a service doctor who made a previous examination had told him that "he was in a dangerous way." A young Marine was alarmed when he was advised that he was being returned to duty. He said, "How am I able to do duty, my blood pressure is still as high as it ever was!" Worry about high blood pressure engenders more high blood pressure and it is known that many persons with essential hypertension live out their life span without any of the complications of hypertension.

Disposition of patients.—The diagnosis and the disposition of many of these patients in military service is difficult. I have seen many men of 40 years of age or less discharged as war casualties because of a diagnosis of arterial hypertension in the 16 months which have elapsed from July 1944 to the time this article was written.

Often the story in this group of patients which come to the hospital because of arterial hypertension was that of a borderline hypertension at time of induction or appointment.

CASE REPORTS

Case 1.—A young aviation cadet of excellent physique receiving his annual physical examination before being commissioned was found to have a blood-pressure reading of 154 mm. systolic and 92 mm. diastolic. He was sent from doctor to doctor elsewhere and examined and re-examined for fitness for appointment. His blood pressure climbed, keeping pace with his nervousness because those findings indicated his future, and his ambition was to win that appointment. The blood pressure on examination at the naval hospital was labile but after observation it conformed to the Bureau of Medicine and Surgery's requirements. The patient was returned to duty for appointment after special examinations revealed no complications of hypertension.

Though this young aviation cadet was appointed to a commissioned status, as clinicians, we know that he has potential hypertension. A patient possessing a definite hypertension at one time may present a normal blood pressure at another. He still has hypertension. The blood pressures of hypertensive patients, especially in the early stages,

are labile. Insurance companies realize this and on insuring individuals take into consideration high figures, even if transient.

Case 2.—A man 24 years of age after 4 months' service at an air base complained of headache, dizziness, and nervousness. His extremities perspired so that sweat dripped from his hands and he could wring water from his socks. His blood pressure was 164 to 204 mm. systolic and 100 mm. diastolic. Investigation showed that he had known he had high blood pressure for 5 years and had received treatment from two civilian doctors. At the time of induction he had been checked and rechecked at rest for his blood pressure and it was finally recorded as 150 mm. systolic and 90 mm. diastolic.

Case 3.—A man 30 years of age after 3 months and 10 days in the service was admitted to the hospital complaining of nervousness, headaches, and dizziness. He also stated that he had had epistaxis several times a week for 15 months. Physical examination was negative except for a blood pressure reading of 162 mm. systolic and 120 mm. diastolic. Investigation revealed that he was told he had high blood pressure 5 years before when applying for a job. His symptoms had been progressive during the previous 2 years and recently he had fainted several times.

In both cases 2 and 3 the men probably had definite organic cardiovascular disease.

Case 4.—A "Seabee," 23 years old, had had 1 year and 7 months' duty when he was admitted to the sick list in the field because routine physical examination revealed blood pressure readings of 220 mm. systolic and 110 mm. diastolic. On questioning he stated that recently dizziness and easy fatigue had been associated with working in the heat. Funduscopic investigation revealed moderate arteriosclerotic changes without any other complications of hypertension. Because the man denied any knowledge of hypertension prior to enlistment the examining board held that his disability had arisen in line of duty and he was discharged.

Case 5.—A seaman, first class, 41 years old, enlisted because he "had always wanted to be in the Navy." Ten months later while he was still in training school hypertension was diagnosed. Two months later he was in the hospital complaining of easy fatigue, insomnia, aching, numbness and tingling in his arms and legs, shortness of breath, and restlessness in general. He stated that he just could not hold up under the rugged duty aboard a mine sweeper. Investigation revealed that he had had some unusual fatigue while working in a defense plant before enlistment. His blood pressure had not been determined prior to enlistment since 1929 when he had successfully passed an insurance examination. At the recruiting station he had been checked and rechecked for his blood pressure and finally it was recorded as 150 mm. systolic and 86 mm. diastolic.

These histories can be multiplied. There are also patients whose blood pressure is elevated only occasionally but who have many complaints. Zeal to get into the Navy together with repeated examination of blood pressure at rest or after sedation are factors in their final acceptance.

The arguments for and against accepting or keeping men in the military service who possess borderline blood pressure readings are numerous. Since hypertension under our present standards is common in certain ages, it is possible that our standards may be too

high at those ages. A person of good physique with a slight or moderate hypertension would be valuable at duty for many years.

Rogers and Palmer (7) reported on the morbidity and mortality of two groups of patients. One group had mild benign essential hypertension, that is, continued variable hypertension with minimal organic changes; the other group had late benign hypertension with marked organic changes in one or more of the three vital regions. The composite view indicated in general a favorable outlook for essential hypertension up to the age of 50 years. From their study they concluded that transient nervous hypertension, taken as the first sign of hypertension, need not disqualify individuals for military service, especially if they are less than 40 years of age. Experience has shown that hypertension in many persons is not incompatible with a high degree of mental and physical efficiency over long periods of time, and in young individuals the blood pressure is transiently elevated rather than transiently normal.

Against these arguments are the facts that even a single hypertensive blood pressure reading may be significant of future hypertension and that some of the candidates and naval personnel already have cardiovascular disease.

It has been stated (4) that anyone with a definite high blood pressure has no place in the Navy for general service and even a single diastolic reading beyond 100 to 110 mm. of mercury should disqualify a man. In every borderline case a complete physical examination should be performed. This examination should include a roentgenographic examination of the chest, an electrocardiogram before and after a standard exercise test, urinalysis, and funduscopy examination.

In order to obtain the needed number of men in the service many men who had a borderline type of blood pressure have been taken. The height of the blood pressure is progressive with age and any increase usually is not due to war service. Selectees of the type now are and will continue to be an expense to the Government.

The final disposition of the previously-mentioned 206 patients who were received into the naval hospital in which I did this study, between 1 January and 31 August 1944, with a diagnosis of arterial hypertension, is given in table 2.

TABLE 2.—Disposition of 206 patients who entered the naval hospital because of hypertension

To duty.....	102
To change of diagnosis.....	51
Discharged from service.....	44
Transferred to new duty.....	9
Total.....	206

The best treatment for the complaints of symptoms of hypertension is removal of the patient from his environmental difficulties or help so that he can make an adjustment to them.

COMMENT

Future evaluation of the hypertensive data in the present military age group will assist in furthering the knowledge of this disease entity.

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THE TREATMENT OF RENAL COLIC WITH SPECIAL EMPHASIS ON CRYSTALLURIA¹

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These preliminary remarks are merely a prelude to the main subject, namely the treatment of renal colic crystalluria.

For over 15 years dieto-metabolic urology has been my chief professional hobby so to speak (1) (2). At first very little appeared on this subject in medical literature but the experiences of many physicians all over the world, especially during and since World War II, as well as many private and group original investigators have emphasized the importance and frequency of this subject until now it is common not only in urological publications but general medical journals as well. Many urological research workers are still busily engaged in different aspects of this obtruse but most interesting subject. The more investigating the more new aspect and fields of endeavor are presented. While "much water has flown under the bridge" more is in the offing. In fact all we can say at present is that we are all mere neophytes and academics for at this writing while we have learned much, we must acknowledge that we have not even "gotten to first base" for we have yet to find the definite etiological factors that cause this distressing motley group of painful symptoms. Its origin is still an enigma as it is pleomorphic in its presenting features. It may occur but once or recur over and over again to doom its victim to a life of invalidism and ultimate uropathic death. Keyser (6) attributes four outstanding contributions to stone research in our generation as follows:

First, Osborne's demonstration of lithiasis in vitamin-starved animals which was developed so thoroughly by Higgins and others. Second, the experimental production of stone in animals by excessive excretion of crystalloids such as oxamide, calcium oxalate, and calcium carbonate with later clinical confirmation of such a hyperexcretory mechanism in hyperparathyroid disease, in gout, and in certain unexplained hypercalcinurias, as was brought out by Albright, Hensch, Flocks, and others. Third, the production of calculi in animals with type specific bacteria by Rosenow and Meisser, Hager and Magath, Hryntshak and myself,

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was correlated with the clinical findings of such bacteria in stone forming kidneys. Fourth, Randall traced the morphogenesis of aseptic stone arising on calcium plaques or in crystalline clogged pyramidal tubules.

It can readily be seen from these different approaches that the implications are still decidedly controversial from demonstrating a single cause of stone formation. They demonstrated clearly that many biopathological mechanisms are probably factors in each case. Then too we cannot escape the fact that urinary calculi is not a disease entity per se but is a variable hybrid form of abnormal concrete formations which may result in many types of pathology other than in the kidneys such as rheumatism, arthritis, gout, neuroses, arteriosclerosis, and calcareous deposits in many other tissues of the body. Its formation as well as its deposition is a weird, strange, complex metabolic anomaly. In physiological metabolism a most complicated biochemical transformation from intake to output occurs. The chemical change of foods, water, fluids, and even air we breathe, on through our systems, and thence out as katabolites through our various emunctories, particularly urinary, are still complex and complicated and too little understood.

Neither age, race, diet, genito-urinary pathology, season, geography, physiochemistry, endocrines, occupation, etc., are solely at fault, but apparently one or more group together to produce it. The incidence among World War II troops was 10 times greater in whites than black races, and occupation had no relation to incidence (3). Why? is the question.

Dieto-metabolic urology may be chiefly divided into (a) urinary and (b) genital. It is my purpose to deal only with the urinary phase in this article and only the primary or so-called aseptic or metabolic stone types in contradistinction to the septic or obstructive stasis calculi. Of course they are often interlocking, especially in the more chronic forms. These cases may be acute or chronic. Since the introduction of the sulfa drugs acute attacks greatly increased in frequency. Some patients are clinically and microscopically hyperexcretory calculi formers (amorphous or crystal) as seen frequently in hyperparathyroidism, bone fractures, traumas, etc. Certainly metabolism, enzymes, hormones (4), and endocrines play most important parts therein. In the main, however, while our present conservative methods are decided improvements over past ones, at the same time they are still totally inadequate especially in dealing with dense large calculi and recurrent attacks. However, it is the smaller stones that cause the most trouble for they can move more and it is the shifting and blockage that causes the most pain and discomfort. In addition to the above it is important to remember that hydrogen ion concentration, dehydration, and minerals in the water content are three of the

most important contributory factors in the production of renal colic, and they may occur separately but generally are together.

There have been many ways of producing stones: (*a*) Chronic infections, (*b*) diet, (*c*) trauma, (*d*) poisons, (*e*) by altering the mineral content in the diet and water fluids, (*f*) deficiency in vitamins, especially "A" in diets, (*g*) estrogens, (*h*) hormones, (*i*) urinary stasis, (*j*) alkalinuria, (*k*) dehydration (*7*).

The symptoms of this condition are generally acute and excruciatingly painful, therefore quick relief is sought. The patient frequently presents all of the symptoms of an acute surgical abdomen, and hence the differential diagnosis is often difficult.

TREATMENT OF RENAL COLIC CRYSTALLURIA

1. Stop all previous medication and diet.
2. If vomiting is excessive, 1,000 cc. of 5 percent dextrose in either Hartman's solution or physiological salt solution intravenously every 6 to 12 hours as indicated.
3. Force distilled water by mouth, 75 to 80 percent in morning or before 3 to 4 p. m.
4. No diet for first 24 hours and liquid diet after that as long as fever, colic, and pains persist. Later acid ash diet and increase in vitamin A as oil of percomorphum.
5. No nourishments between meals.
6. Make repeated clinical laboratory tests of (*a*) urine, (*b*) blood count, (*c*) blood chemistry, especially nonprotein nitrogen, sugar, creatinin, chlorides, and uric acid. Also physical examination and blood pressure.
7. Give saline or soda enemas, starting with small, low, very warm ones and gradually increasing to colonics or "slushes."
8. Apply heat off and on to affected side.
9. Flat x-ray, later an intravenous, and last a cystoscopy. I feel that surgery is indicated before retrograde catheterization. I realize that this is unorthodox and contrary to generally adopted procedure, but I can only say that after several years of experience in this line, if I were the patient this is the way I would insist on being treated for after all "self-preservation is the first law of nature." Please remember that it is the most natural mechanical and physical way for "water does not flow uphill" and retrograde manipulations are all that this word implies and surely it is like "bucking the tide" and "swimming against the current." It is my opinion that there have been many kidneys removed as a result of unnecessary retrograde instrumentation. I apply this so-called delayed retrograde method only in cases of acute renal colic.

10. Involuntary muscle stimulator drugs are used. Neostigmine methylsulfate (prostigmine) to therapeutic tolerance night and day at first and gradually decreasing the frequency and strength.

11. After 3 or 4 days alternate involuntary muscle dilators with stimulators. The best of these dilators that I have used to date are trasentin plain and with phenobarbital, and various belladonna alkaloids, especially those with hyoscyamus, hyoscine, and atropine.

12. No opiates, as they mask the symptoms and "give a false sense of security." Except temporarily relieving pain they counteract every other constructive effort.

13. From the above it can be seen that each case is treated differently and chiefly symptomatically for "each is a law unto itself." The above are merely the general tentative highlights and cardinals tersely stated *seriatim*.

14. "Prevention is better than cure." I believe this line of treatment lessens the severity of attacks and prevents the incidence of recurrences. Orr states (5) that about 15 percent of his series came to operation, but in my own practice in over 200 cases only 5 have been known to come to operation.

SUMMARY AND CONCLUSIONS

The etiology of aseptic renal crystalluria is still indefinite, varied, and pleomorphic.

The three chief causes of aseptic renal colic besides altered metabolism are believed to be (*a*) dehydration, (*b*) altered hydrogen ion concentration, and (*c*) mineral content in the drinking water.

The treatment given is chiefly symptomatic with emphasis on nursing detail; acid ash diet with high vitamin A intake; forcing fluids, especially distilled water; enemas at first and followed later with colonic irrigations, "slushes," etc.; medication consisting of involuntary muscle stimulators to therapeutic tolerance (preferably neostigmine) and later dilators (preferably trasentin and the belladonna alkaloids); and keep urine very acid (except cystine stones alkaline) pH of 5 or under. This is very hard to do.

No opiates, as they mask and distort the clinical picture and "give a false sense of security."

"Eat to live and not live to eat," for "prevention is better than cure."

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EFFECT OF FAT ON GASTRIC RESPONSES TO FOODS

Determinations of the stomach-evacuation times of healthy human subjects fed on test meals of foods cooked with varying quantities of fats are described; the day-to-day variations in gastric evacuation times ranged from 0 to 30 min. (average deviation from the mean of ± 17 min.). When moderate amounts of fat were incorporated by baking or frying according to good culinary practice, there appeared to be no relationship between fat content of the food and the gastric emptying time; thus French-fried and sauté potatoes were evacuated from the stomach as rapidly as boiled potatoes. Similarly, doughnuts were evacuated in the same time as bread and butter of like fat content. The addition of excess of fat to such foods (making them "greasy") did prolong the evacuation time. The addition to a test meal of glucose and water of hydrogenated vegetable fat or of butter fat (=66% of the glucose), retarded evacuation of the glucose. As an explanation of these effects it is suggested that excess of fat, which will rapidly separate from the food during gastric digestion, may act on the gastric mucosa or small intestine so as inhibit gastric secretory or motor functions.—KILLIAN, J. A. and MARSH, N. E.: Effect of fat on gastric responses to foods. *Brit. Abstr. AIII—Physiology, Biochemistry, Anatomy*, p. 284, April 1946.

CHRONIC ASTHMA

Results of Treatment in 100 Cases

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The problem of what happens to the allergic individual who is taken into the military service is an important one from the standpoint of cost to the Government for care of illnesses developed while in the service, and as to how much time is lost by such persons being in the hospitals. While no accurate figures are available as to the exact number of allergic persons enlisted, it was the policy of the Navy to not enlist persons with chronic asthma or disabling allergy of any type. Minor allergic disorders were not considered disqualifying, however, and this paper is primarily concerned with that group of people whose allergy was of moderate importance in civilian life, but disabling in the military sense.

During a period of 1 year, 1 September 1944 to 1 September 1945, 282 enlisted personnel were admitted to the U. S. Naval Hospital, St. Albans, N. Y., with an allergy diagnosis, and were treated on a ward designated as an allergy ward. Of this number there were 26 with allergy (nose and throat); 44 with urticaria; 14 with chronic bronchitis; 21 with hay fever; 4 with dermatitis; and 173 with asthma. It is in the asthmatics that the greatest morbidity and the highest number of discharges from the service is found. It is generally accepted that most of the asthmatics must have had a pre-enlistment history of either asthma attacks or a more or less chronic respiratory difficulty. The unusual amount of time necessary to treat and work out some disposition for these patients should be more widely understood by naval medical officers.

Asthma is considered by many to have a large psychogenic component in both the production of the original attack and its prolongation into a chronic disorder. This aspect of it has interested us because it may explain the long period of time on the sick list seen in Navy personnel with that condition. Just how much of this is a conscious element is difficult to ascertain, but certainly a small number of cases does clear up remarkably once their "survey" is written and their discharge decided upon. On the other hand, the Navy has a large, if not a larger group of men who consciously conceal the fact that they have had asthma prior to enlistment in a sincere desire to join the service from purely patriotic motives. In a large percentage of asthmatics

the disability may be minor and successfully concealed throughout service and upon contemplating separation from the service, the person often desires complete studies at that time. This is particularly true of officers who are able to adjust their duties to mild limitations, and yet are aware of having chronic asthma throughout their naval careers. In this series of cases only enlisted personnel were included. All patients were severe asthmatics requiring hospitalization, and they were for the most part chronic cases with one or more admissions to the sick list with this disability.

One problem is whether asthma could be caused entirely by service conditions or whether allergy is fundamentally a constitutional disorder and as such must have existed prior to enlistment. A small percentage of the cases in this series are designated as "intrinsic" asthma and are thought of as the type in which infection, either sinusitis or bronchitis, is the major cause of the continued disability. A typical story in this type of case is that the boy reports to "boot camp," contacts large numbers of people and immediately comes down with scarlet fever. Upon recovering from this he may complete his "boot" training and then go on leave during which he contracts pneumonia, either bacterial or virus in etiology. During this time he begins to wheeze, cough, and raise stringy, tenacious sputum. This then continues chronically and repeated admissions to the sick list follow with various diagnoses as chronic bronchitis, catarrhal fever, and pneumonia, primary atypical. Finally after several admissions the diagnosis, asthma, is established and the patient surveyed out of the service. This type is undoubtedly a service-connected disability.

On the other hand a large proportion of the patients with onset of asthma in the service definitely has a pre-existent constitutional predisposition to develop it. In these cases the family history is usually positive for allergy; the onset is usually when in a completely foreign environment; and skin tests are usually highly positive, indicative of an atopic type reaction. While service conditions may precipitate the original attack this should not be considered more than aggravation by service, inasmuch as the probability is that they would have developed asthma at some time or other irrespective of military service.

There is still a third type of asthma which develops under stress and is merely one manifestation of an inadequate personality. This is the person who can develop wheezes with exertion, who is a frequent complainer at sick call, and who tends to exaggerate all symptoms. Upon observation in a hospital repeated chest examinations are negative, and yet when sent to duty he immediately returns because of "wheezes." This third type of asthma could not be considered as entirely caused by service conditions.

In this series there were 100 unselected cases reviewed with the following results: The average length of service prior to their admission to the sick list was 21.2 months. Of those who had asthma prior to enlistment, the average duration of asthma was 13.2 years. In the entire series 22 cases were considered to have been incurred as a result of service. Of this group of 22 cases, 9 were so-called intrinsic in etiology (infection), 2 were psychogenic, and 11 were atopic in origin. Of the total group 82 percent was discharged from the service and the balance or 18 percent returned to some type of duty, usually limited shore duty. The average number of days on the sick list for the series was 114.5 days per case. The breakdown on the cases was 70 atopic allergy cases, 26 of intrinsic origin, and 3 of psychogenic etiology, with 1 case of aspirin sensitivity. Of the intrinsic asthmatics 2 cleared up while 24 remained unchanged after treatment. Of the atopic group 29 cleared completely while 41 remained unchanged. The results, then, were 32 percent cleared under treatment while 68 percent still had asthmatic findings in their chests up to the time of discharge. The long period on the sick list included in many cases a period of up to 30 days' leave and often delays necessitated by conditions peculiar to the service in that careful records were necessary.

Of the cases shown to have an atopic type history and response to skin test, there were many cases of multiple sensitivity. Forty-four had positive dust reactions, 37 were sensitive to ragweed, 25 positive to grasses, 10 significantly food sensitive, and 18 sensitive to one or more animal danders. Of this group of cases all were given desensitizing doses of appropriate extracts. Practically 100 percent of these cases gave a positive family history of allergy and had a history of seasonal variation to their attacks. Several of them had evidence of superimposed infections in that 8 cases on admission had either a leukocytosis or an increased sedimentation rate determination which later became normal. Twenty-three cases showed clouding in one or more sinuses by x-ray examination. Two cases showed increased bronchovascular markings, 1 pulmonary fibrosis, 1 pleural thickening, and 1 frank pneumonia on x-ray examination. In all but a very few of the atopic cases the improvement was definite and quite marked but in 41 cases there were persistent "wheezes" up to the time of discharge. The reason that they were not classed as well individuals was because all naval personnel are required to be physically fit to perform all duties ashore, or, they cannot be sent to any duty. Most of the cases classed as showing no change would be classified in civilian life as fully able to tolerate full activity and carry on normal work. All cases had received the maximum benefit from hospitalization at the time of their discharge, and no patient required further care at that time. While the results in the atopic group do not appear to be

good, the improvement was much more than the record shows in the average case. Everyone was thoroughly studied and treatment was given up to the maximum in keeping with best medical practices as they are known today.

There are certain peculiarities of Navy life that make it difficult to control asthma or to adequately treat it while on duty. Control of the environment is impossible because it is impractical to alter sleeping quarters, mess halls, or other places of duty to conform to one person's sensitivities. The same applies to duty in that it is not feasible to give a man light duty or restricted activity over any length of time due to effect on morale as well as the need for the man's services at that time. New allergens are continually being contacted in a world-wide cruise in the Navy and hence a person with a basic predisposition to asthma is bound to have repeated upsets in different localities. There are many factors inherent in the type of duty a man has to do in the Navy which makes his adjustment difficult, such as exposure to all kinds of weather, working in humid firerooms, and particularly dusty work as chipping paint. All these factors taken into consideration preclude the return to duty of any sizable number of chronic asthmatics.

In the intrinsic group there were only 2 cases that cleared up, and 24 were discharged, still having positive chest findings. In this smaller group were found 13 cases with abnormalities in one or more sinuses by x-ray, 1 case of pneumonia, and 2 cases with increased broncho-vascular markings. In only 2 cases were there abnormal blood findings as evidence of infection. All skin tests were negative in this group. Treatment consisted largely of symptomatic care in 18 cases and symptomatic treatment plus catarrhal vaccine in 8 cases. Two patients received long courses of penicillin with improvement. The general impression was that the intrinsic type of asthma occurred in a slightly older age group in that 7 of these cases were in the ages 25 to 35 at the time of admission to the sick list. Another impression in this group was that these patients possessed a constitutional predisposition to infections, particularly those of respiratory type.

The psychogenic type of asthma was found in 3 cases, 1 of which cleared up and 2 persisted in having "wheezes." Here the conscious element plus certain degrees of constitutional inadequacy was present and prolonged the disability beyond the usual duration of a mild psychoneurosis. The lack of motivation for naval service, coupled with the feeling of a need for attention, seemed also of primary importance in these cases.

CONCLUSIONS

1. Asthma cannot be successfully treated in a military environment where many factors are beyond the control of the physician.

2. Asthma produces disability over longer periods of time than most illnesses as evidenced by an average time on the sick list of 114.5 days per patient.

3. In a series of 100 hospitalized cases 78 percent of asthmatics had a positive preenlistment history of asthma.

4. Protein sensitivity or atopic asthma was present in 70 percent of cases received.

5. Intrinsic infection accounted for 26 percent of cases.

6. In atopic asthma 41 percent of cases cleared under treatment.

7. Of a series of 100 cases 18 percent were returned to duty.

8. Morbidity figures bear out the wisdom of the Navy in not accepting men with pre-existent asthma for enlistment.



"GOODBYE, MR. RAT"

In an article, entitled "Goodbye, Mr. Rat," condensed from the *Farm Journal*, there is a discussion of the use of 1080 as a rat killer and the dangers in its use.

Alphanaphthylthiourea, abbreviated to Antu, kills the common brown or Norway rats, "is also a powerful killer, yet isn't as dangerous to humans or stock as 1080."

"One pound of Antu can kill 200,000 rats.

"It has one weakness. If the rat doesn't get enough poison to kill him the first time, he builds up a resistance to it. * * *

"At least six effective ways have been found to use Antu: (1) In a 2% to 5% mixture with finely ground grain such as wheat or corn; (2) as a spray or dust on ground grain or fruits and vegetables; (3) as a dust, either in pure form or mixed with flour, to be placed in runways or on floors; (4) as a dust on the surface of water; (5) as a dust blown into the burrow and holes with a standard dust pump; and (6) as a suspendable powder in water."

Antu is not poisonous to domestic fowl, and plant-eating animals, but is to dogs, pigs, and other meat-eating animals. It is probably not poisonous to man as tests on monkeys have shown no ill effects. Cysteine holds promise as an antidote for Antu.—*Farmer's Digest* 9: 65-66, Apr. 1946.

THE WARTIME LOG OF A UNITED STATES NAVY HOSPITAL SHIP TO JUNE 1943 ¹

Part IV

RICHARD A. KERN
Commodore (MC) U. S. N. R.
and
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Captain (MC) U. S. N.

During the period when we were evacuating casualties, there came up numerous problems that were new in the experience of our own hospital ships in this war. The lessons learned in solving them have proved helpful to others to whom we were able to communicate our experiences. It therefore seems wise to make them a matter of record.

PROBLEMS OF OPERATION

The problems arose primarily in connection with the reception of patients in large numbers within a very short time and their discharge under similar circumstances. Thus, on one occasion, 461 patients came aboard in 2 hours and 40 minutes; on another, 502 patients in 3½ hours; we have discharged 501 patients in 1½ hours.

Then there was the matter of distributing these patients to the proper wards, with the types of cases varying from trip to trip and in extremes of 90 percent surgical and 10 percent medical at one time and 65 percent surgical and 35 percent medical at another. These cases would vary in turn as to the number in certain important categories such as contagious cases, psychotics in restraint, officers, and enlisted men. All this was further complicated by the need to decide whether the patient was to be put in a lower or an upper bunk in a ward, or in a bunk vacated by a member of the crew, or on a cot set up in yet other spaces, the latter two expedients made necessary when the patients on 10 trips exceeded the hospital bunks on board. And had the newly arrived patients been recently fed? At the other end of the run, much the same problems were present in reverse, with the additional one as to the patients having clothing in which to leave the ship.

¹ This is the final installment of this article.

The first step in solving these problems lay in making the operations of receiving, distributing, and evacuating the patients the primary responsibility of one medical officer. Commodore Kern so functioned during the handling of the first 7,000 patients evacuated. Then an additional officer was trained in the work, so that two experienced men should be available. All major admission and evacuation activities were carried out under the supervision and direction of the senior medical officer of the ship.

The admitting officer's first duty before making a port where many patients were to be received was to pass the word to all services to make room for as many serious cases as possible by (1) discharging to duty or transferring to their bunks in their own quarters those members of the ship's company on the sick list who could be so dealt with; (2) transferring to the convalescent ward any patients able to fend for themselves in the cafeteria foodline; and (3) transferring to upper bunks any of the remaining patients who could be so moved. When all shifts had been completed, a count was made of the number of vacant upper and lower bunks in each ward.

In the office of the medical officer of the day, just off the quarter-deck, was kept a set of cardboard tickets the size of an ordinary theater ticket, red for upper bunks, white for lower bunks and cots. Each bore on its face in large letters a word, e. g., EENT, SURG, UROL, and type of bunk (U, L, Cot). The pharmacist's mate on duty in the M. O. D.'s office, when he had the empty bunk census in all spaces, counted out the exact number and kind of tickets for the empty bunks in each ward and held them in bundles by wards with rubber bands.

As soon as the ship came to anchor, the senior medical officer ascertained from the facility about to transfer patients the following facts: (1) The total number of patients to be transferred; (2) the number of psychotics in restraint; (3) the total number of neuropsychiatric cases; (4) the number of contagious cases and the types of infection; (5) the number of stretcher cases; (6) the number and names of patients in a critical condition; (7) the number of wounded; (8) the number of fracture cases, and of fractures of the femur; (9) the number of burn cases; (10) the number of eye cases; (11) the number of officer patients; (12) the number of civilians and of non-Americans; (13) when the first patients would arrive alongside; (14) when the patients were last fed; and (15) when the records, transfer list, x-ray films, and baggage would arrive.

Armed with this information, even if only approximate, the admitting officer could plan how best to distribute the impending patient load. He could also inform the supply officer how many patients were to be received, when they had last eaten, and how many would be fed in the general mess (ambulatory patients).

When the time for receiving patients was near, the quarter-deck was cleared of loiterers and sufficient mess-benches set up to accommodate from 50 to 80 ambulatory patients. A group of writers, 6 to 8 in number, was mustered, prepared to get certain information from each patient, including his name, rank or rate, service number, original ship or organization, transferring facility, ward to which sent, whether stretcher or ambulatory, time, and date. This was done on mimeographed sheets of paper that could later be cut into strips with one man's data to be attached to the individual's record, and in duplicate by means of carbon paper, so that one copy could be sent to the general office and the other to the medical record office. Stretcher bearers were hailed to the quarter-deck when the first boat with patients hove in sight.

With the tickets for all the empty bunks in his hand, the admitting officer questioned each patient as soon as he was seated on a bench or when his stretcher had been deposited on the deck. The task in hand was to make a quick diagnosis adequate for an intelligent assignment to ward and bunk. The question, "What is your trouble?" at times brought an adequate answer. Often it was necessary to ask more questions. Certain ones that often proved helpful are worth mentioning. If a man had severe burns, he was asked if he had in addition any wounds or fractures. Uncomplicated burns were sent to a medical ward, those with wounds as well, to a surgical ward, and the fracture cases to the orthopedic ward. If a patient in a stretcher had evidence of a wound near the pelvis, he was asked if he had trouble in voiding, and if so, was sent to the urological ward. If a man said he had malaria, he was asked when he had had his last chill, as a guide to the state of progress of his treatment and consequent need for close or less close supervision. If a man had insufficient clothing to give an idea as to his rank, it was well to ask, and so avoid the later need to transfer an officer from a ward to sick officers' quarters.

In addition to the diagnosis, other factors might determine the ward to which the patient was to be sent. Thus, if it was known that a larger number of fracture cases was to be admitted than there were empty bunks in the orthopedic ward, then less severe fractures, perhaps of an upper extremity and already immobilized in plaster, would be sent to the medical ward nearest to the orthopedic ward. Or if there were fewer fracture cases than available orthopedic bunks, then some of the latter might be filled with surgical or medical cases of lesser severity. If there were more wounded patients than surgical beds, then milder cases were sent to the urological ward or to the nearby medical ward. Patients with diseases requiring special diets, e. g., diabetes, were sent to a medical ward so that they could be fed from

the special diet kitchen. If an eye lesion was serious, the patient would be sent to the eye ward, regardless of coexisting lesions other than urinary incontinence.

The sick officers constituted a never-ending problem. S. O. Q. had only 12 beds, in 8 rooms, yet the number of officer patients was nearly always in excess of this number, and once as high as 56. Fortunately there is a 50-bed emergency ward next to S. O. Q., which could be used for the overflow. All officers were sent to S. O. Q. for the purposes of admission, the worst cases placed in beds in rooms, and the less serious in lower or upper bunks in the emergency ward, the remaining bunks of which were filled with enlisted men.

When the admitting officer had decided where to send the patient, he gave him a ticket for the ward and bunk in question and passed on to the next patient, stretcher cases always getting preference. Immediately behind the admitting officer came a pharmacist's mate who recorded with a counter each ticket as it was passed out, and who at any moment could tell the admitting officer how many patients had come aboard. Behind him, in turn, came the writers who recorded the admission data mentioned before and then gave the patient a green slip of paper. That was the signal that a guide or stretcher bearers could take that patient to his ward. Sentries were stationed at all exits from the quarter-deck to make sure that no patient left or was taken from the quarter-deck unless he had both a ward ticket and a green slip to show that he had been properly logged.

When a patient was in an obviously serious condition, the admitting officer sent word to that effect to the receiving ward officer. When a psychotic patient arrived, he was put in the M. O. D.'s office and the psychiatrist was at once sent for, to decide how closely restrained he should be, or even be given an intravenous hypnotic. Laymen on the quarter-deck never failed to be impressed when the raving maniac who had entered that room a few minutes before was carried out sound asleep.

It is obvious from the foregoing that the role of admitting officer is best handled by a medical officer with considerable clinical experience.

When the admitting officer noticed that he was nearing the end of the tickets for a given ward, he counted the remainder and checked with the ward by telephone as to the accuracy of the count. Through the boat crews he could keep in contact with conditions on the beach and learn how many stretcher cases and how many ambulatory cases were still waiting there. If it looked as if a number greatly in excess of those originally reported was being sent, then it would become necessary to refuse some of the patients. Under those circumstances, all stretcher cases were accepted, but the last ambulatory patients

were impounded on the quarter-deck without bunk assignment, and the excess number sent ashore in the last boat. Fortunately, this had to be resorted to only on two occasions.

During the reception of patients all medical officers were required to be on their wards. If they found it necessary to put in a lower bunk a patient with an upper bunk ticket, they at once notified the admitting officer on the quarter-deck of that fact by telephone, so that he could make the necessary correction in his ticket supply. When patients reached their wards, their bunk tickets were collected by the nurse in charge and saved for use in the next operation.

Before considering the operation completed, the admitting officer, and pharmacist charged with the duty, and the executive officer's yeoman assured themselves that all baggage, health records, service records, pay accounts, and x-ray films had been received, and that all stretchers, blankets, and other property belonging to the sending facility had been returned ashore. This was reported to the senior medical officer who made his reports to the commanding officer.

On the day before the discharge of a large number of patients, the senior medical officer was informed by the commanding officer of the probable hour of arrival and which side of the ship would be next to the dock. The supply officer was also notified of the probable time of evacuation so that he could plan when to serve the last meal. Every effort was made to feed patients within an hour of the time of disembarkation. Those in charge of baggage and records were similarly notified. From the transfer list of patients made in the medical record office, the evacuation officer prepared a break-down that gave the following information on a single sheet of paper: The total number of cases evacuated; the number of officers and enlisted men; the number in turn of each of these for the respective branches of the service, Navy, Marine Corps, Coast Guard, Army, etc.; the number each of critical cases, serious cases, those of contagious disease, psychotics in restraint; the number each of stretcher and ambulatory cases; the number of bodies of the dead; the total number of surgical cases, with a secondary breakdown into categories of wounded, fracture cases (simple and compound), burns, urological cases, eye cases, ear, nose, and throat cases; similarly the total of medical cases, with a secondary listing of neuropsychiatric cases (psychoses, neuroses, epilepsy), malarial cases, other infections, respiratory cases, gastro-intestinal cases, cardiovascular cases, and skin cases.

In each ward, a white linen shipping tag was prepared for each patient, giving the name, rate, diagnosis, and whether stretcher or ambulatory. For those in a serious or critical condition, a red tag was used (made by dipping a white tag in red ink and letting it dry). The nurse in charge of each ward informed the medical record office

of the numbers of stretcher and ambulatory patients to be discharged from that ward. All ambulatory patients were checked as to adequate clothing and shoes. It must be remembered that many patients came aboard with little or no clothing, and at first we had to send some ambulatory patients off the ship in stretchers for lack of clothing. The supply department rendered splendid service in acquiring a stock of clothing and shoes that fully met this need.

The receiving facility was notified by dispatch, as early as circumstances permitted, as to our probable time of arrival, the total number of patients to be transferred, and the number of stretcher cases. They could then make their plans as to the number of ambulances and busses to provide. When possible, an admitting officer from the receiving facility boarded the ship with the pilot, and so was able to gain an hour or two during which he could designate the wards in his own hospital to which each patient was to go (best done by a red grease-pencil note of a large ward letter or number written on our tag).

An hour before evacuation, all patients were required to go to their wards and remain there until sent for. The linen tags were tied securely to the patients in such a way as to be plainly visible.

The gangways were rigged, one forward through a cargo port in addition to the usual one from the quarter-deck. The ambulances stopped to discharge their stretchers at the forward gangway before going on to the after gangway to receive filled stretchers. Empty stretchers were brought aboard over the forward gangway where a chief pharmacist's mate, who had a list of the number of stretcher cases in each ward, directed the bearers to the wards in a way to keep traffic moving smoothly.

The evacuation medical officer, assisted by the pharmacist in charge of personnel, took station at the after gangway over which the filled stretchers were carried to the dock to the waiting ambulances. Guided by messengers sent from the quarter-deck, the ambulatory patients were brought from the wards to the outboard side of the evacuation deck, and marshalled in single file along the rail around the fantail and so to the head of the gangway. Here they were counted off and sent ashore in numbers sufficient to fill each bus as it arrived. The inboard side of the evacuation deck was kept clear for one-way traffic of filled stretchers to the after gangway. At the foot of the discharging gangway four checkers were stationed, each with an alphabetically arranged list of patients being transferred. The name of each patient as he came off the gangway was crossed off by one of the checkers. In this way, patients could be discharged as fast as conveyances arrived to receive them. At the same time, baggage was moved to the dock through a cargo port on a lower deck and loaded into trucks.

The medical officers remained in their wards where they supervised the transfer of patients from bunk to stretcher. Every 15 minutes each ward medical officer notified the quarter-deck by messenger of the number of stretcher and ambulatory patients still remaining in the ward.

At times, special ambulances of unusual width were set aside for the conveyance of patients with double hip-spicas. Psychotics in restraint and patients with contagious disease were evacuated last and into ambulances designated for the purpose by the medical officer of the receiving facility.

Finally, when all wards were reported empty and the checkers had verified the departure of the last patient, the evacuation officer and the pharmacist made sure that health and service records, pay accounts, and x-ray films had been sent ashore and that any ship's property used in the transfer was accounted for. It is a matter of pride that no baggage was lost on board and that only a few pieces were delayed more than a few hours in being put ashore in evacuating 7,445 patients.

THE IDEAL HOSPITAL SHIP

In the light of these experiences, we hope we may be pardoned the indulgence in a few speculations as to the specifications of a hospital ship that would best meet all the needs of the service, both in peace and war. Many of its features would duplicate the splendid ones of the *Solace*. Others are proposed in consideration of her shortcomings.

THE SHIP ITSELF

The ideal tonnage would seem to be 10,000 to 12,000. This would permit of a bed capacity of 500, all fairly compactly arranged in the midship region where a minimum of motion would make for the greater comfort of patients, one of the best features of our own ship. It would also insure greater stability in proportion to the greater tonnage (this ship displaces only 6,200 tons). It would permit of more ample stowage space for medical supplies than this ship has, including equipment for a field hospital, an ambulance, and a general-duty motor vehicle. Finally, she should have a speed of 20 knots, thereby increasing safety from submarine attack as well as efficiency in case it were necessary to use the ship for evacuation purposes.

It might be argued that there is no need for a 20-knot hospital ship, because the evacuation of patients should never be the function of such a vessel. Patients in advanced areas should be held long enough until they have improved sufficiently to be transported in an ambulance ship. That, it is true, is the desirable and usual procedure. But there are emergencies when advanced hospital facilities are so overtaxed by the rapid influx of severe casualties that every type of case must

be moved to the rear as soon as possible to make room for new patients. Under these circumstances patients urgently requiring definitive treatment must be evacuated in such numbers as far to exceed the hospital facilities of an ambulance ship for that type of case. Yet a hospital ship by reason of its equipment and personnel, could easily handle four times as many serious cases as could an ambulance vessel. It is then that one 20-knot hospital ship would be as valuable as four ambulance ships for evacuating serious cases.

An important item in her general design would be an ample quarter-deck space, much like the lobby of a hospital ashore. It should be large enough and laid out to accommodate a considerable number of patients coming aboard in a short period of time, without interfering too much with routine ship's business. In direct connection with the quarter-deck space should be the ship's office, the supply office, the medical record office, the offices of the senior medical officer and the medical officer of the day, a receiving and treatment room, and the chaplain's office. Of vital importance in this area would be a service elevator that could be used for patients, baggage, and supplies.

Gangways and passageways that must be traversed by patients should be of ample width. There should be at least two elevators, one in relation to the quarter-deck, the other near the opposite end of the medical spaces, preferably connecting the surgical wards with the operating-room country.

Air conditioning of medical spaces, especially of operating rooms, would be a most desirable feature. It is a recognized fact that when a hospital ship is operating in company with combatant ships in wartime, it may at times be necessary for the ship to black out at night. The need for adequate ventilation and temperature control under such circumstances is obvious. For the same reason, adequate internal communication between all medical spaces should be provided, to avoid the necessity of handling patients on weather decks at night.

The ship's loud-speaker system should include a separate medical circuit, to be operated from the offices of the senior medical officer and of the medical officer of the day, and with terminals located outside of but adjacent to patient spaces.

MEDICAL SPACES

These should be grouped together to avoid nonmedical traffic through medical country and vice versa.

The Surgical Division.—This should consist of 3 wards of 40 beds each, 1 ward to be used for orthopedic cases. Each ward should be provided with a quiet room, containing two beds, and located near the nurse's desk. There should be an office and examining room

for the ward medical officer. Surgical wards should have dressing rooms of adequate size and equipment.

The operating-room suite should be reasonably close to amidship. It is particularly important that it be next to the x-ray department and in close communication with the surgical wards by elevator. Passageways in the operating-room country must be especially wide to accommodate litters bearing patients. Air conditioning is more needed here than anywhere in the ship.

The *x-ray Department* should be near the operating room and the elevator. Its diagnostic room space should be unencumbered by stanchions. There should be a separate room and equipment for superficial x-ray therapy. There must be head facilities for use in connection with colon studies.

The *Eye, Ear, Nose, and Throat Department* should consist of a 30-bed ward, including a 2-bed quiet room, a clinic workroom that is air-conditioned, and with adequate waiting room space for out-patients; and an air-conditioned operating room large enough to permit bronchoscopy and the housing of a large electro-magnet. The department should be located as near the quarter-deck as possible because of its many out-patients.

The *Urological Department* should include a 40-bed ward with a 2-bed quiet room, an office for the medical officer's and the nurse's desks, and a utility and treatment room sufficiently large and adequately equipped with sterilizing gear so as to be usable as an operating room, not only for urological procedures but also for emergency surgical work in case of many wounded patients (a valuable feature of the *Solace*). There should be an endoscopic room provided with x-ray equipment that in its essentials duplicates those of the x-ray department proper. Since this is based on the thought that one could assume the functions of the other in an emergency, the endoscopic room and the x-ray department should be at opposite ends of the medical spaces.

The *Medical Division* should consist of 3 wards of 40, 40, and 30 beds, respectively, each with a 2-bed quiet room. One of these quiet rooms should be equipped with a respirator. Each ward should have a room provided with a desk and an examining table for the use of the ward medical officer. The smaller should be designed with a view to its use chiefly for mild neuropsychiatric patients. In addition there should be facilities for confining 10 psychotics needing restraint. The latter spaces should be in units of 2 beds, and located aft and top-side, so as to be isolated and quiet, and should be provided with an enclosed deck space for sun and exercise. These units could also be used for overflow from other departments, notably isolation and S. O. Q. (both of which contingencies arose here).

The isolation country should be on the same deck with, and adjacent to the laboratory, preferably in the after part of the ship, so as to be away from much-used traffic routes. This arrangement facilitates the study of contagious cases and makes it feasible for the pathologist to take charge of the patients in the isolation country if no other officer is available. There should be 5 wards of 20, 10, 6, 6, and 4 beds each. The 20-bed ward should be so arranged and provided (e. g., 2 baths and heads) that it could be subdivided by a screen into 2 wards in an emergency. Isolation facilities are not nearly so much taxed from the standpoint of total bed space as by the need for isolating many different types of cases at the same time. Furthermore, the more numerous these isolation compartments, the better they lend themselves to other uses that may arise in an emergency; an unforeseen overflow of patients from other departments, such as psychotics in restraint (this happened here on 2 occasions), officer patients (on 2 other occasions), large numbers of wounds (3 times here).

Two convalescent wards of 40 beds each are advised. They should be located close to the general messroom where these patients would eat. One room with desk and examining table for the use of the medical officer could serve both wards.

Sick officers' quarters should have a capacity of 30 beds, distributed in 10 single and 10 double rooms. At least 4 of these rooms should be provided with showers and heads, since female patients must be looked after in this department. There should be an examining room and office for the medical officer, a small room for surgical examinations and dressings, and a nurse's office. The wardroom should be large enough to seat up to 40 officers at table.

Adjacent to the S. O. Q. should be a space that in peacetime could be an officers' lounge and library, but which could be converted into a 30-bed emergency ward. It should therefore be provided with pantry, closet, bath, and head facilities, and an examining room. This ward could be used as an S. O. Q. overflow when needed, or as a ward for enlisted men with whatever type of diagnoses predominated at the time. When not in use as a ward, this space could also be used for medical meetings, motion pictures, etc. An arrangement comparable to the above has proved invaluable on this ship.

The laboratory should have a deck space of at least 800 square feet (twice the area of that in this ship). A part of this space could be dedicated to a small room in which air currents could be kept at a minimum to insure the best bacteriological technique. The chemistry section of the laboratory should be provided with a hood. In addition, there should be a room to serve the pathologist as office and examining room.

Since in wartime the ship must rely for its supply of laboratory animals largely upon their breeding on board, adequate provision must be made topside for an animal house, properly ventilated in summer and heated in winter, and with runways exposed to sun and air.

The physiotherapy room should be reasonably close to the ward spaces and to an elevator, so that patients could have easy access. The same is true for the room that contains the heart station (electrocardiograph) and the basal metabolism unit.

The dental department ought to be located near the quarter-deck and provided with waiting-room space for its many out-patients. There should be four chairs, one of which could be used constantly for prophylactic treatments, and in the same booth with it could be placed the x-ray unit. There should be a prosthetic laboratory, not only with the necessary equipment but with enough space to let three prosthetic technicians work.

The autopsy room should be fairly near the laboratory. There must be refrigeration facilities in direct communication with the autopsy room. The autopsy table should be so constructed that its top will drain automatically; this is best accomplished with a table rigged fore and aft, not athwartships.

There should be an optical laboratory, for the grinding of lenses for eye glasses and the fitting and adjusting of spectacles. In wartime this is a "must."

There must be a medical library and reading room. Books and journals should not be removed from this room at any time without special permission. The room should be equipped with blackboard, lantern, and microprojector, and should be large enough to be used for staff conferences. (Such conferences were held on this vessel at frequent intervals and on timely subjects. They were well attended by the medical officers of ships in company and of neighboring shore stations. They constituted an important service rendered by the staff of the *Solace* to medical officers in the area.)

PERSONNEL

The figures here to be proposed are based on a full wartime complement. The medical spaces and units mentioned have been so subdivided that a number of units could be closed and the remainder operated by a correspondingly reduced personnel.

There is suggested, in addition to the senior medical officer of the ship, 17 medical officers, apportioned as follows: A chief of surgery, 2 assistant surgeons, an orthopedic surgeon, a urologist, 2 eye, ear, nose, and throat surgeons, a flight surgeon, a roentgenologist, a chief of medicine, 2 internists one of whom is trained in dermatology and 1 in cardiology, a neuropsychiatrist, a pathologist, 3 junior medical

officers for general duty, and 3 dental officers. In peacetime this could be reduced to 13 medical and 2 dental officers.

A wartime complement of 1 chief nurse and 20 duty nurses is ample. Twelve duty nurses would suffice in peacetime.

The Hospital Corps officers, 5 in number, should be assigned to the following activities: medical record office, property and accounting, medical maintenance and personnel, laboratory, and x-ray department. A complement of 180 enlisted men of the Hospital Corps is suggested. These figures are again those of full wartime strength.

SUPPLIES

An additional supply of medical stores should be placed on board in wartime, sufficient to make it possible for the ship to serve as a mobile medical supply depot for emergency issue. It is realized that various difficulties of administration and procedure are involved, as well as the need for somewhat arbitrary decisions as to the nature and quantities of stores to be carried. The fact remains, that the advantage of furnishing vital supplies to distant units early during a war, before the organization of a service of supply is perfected, far outweighs any disadvantages that we can foresee.

This, then, is the ship of our dreams. But she is a dream-ship that well deserves and needs to become a reality. When she does, we have just one more suggestion: That in name as well as performance she continue the proud lineage of her forebears as the U. S. S. *Solace*.

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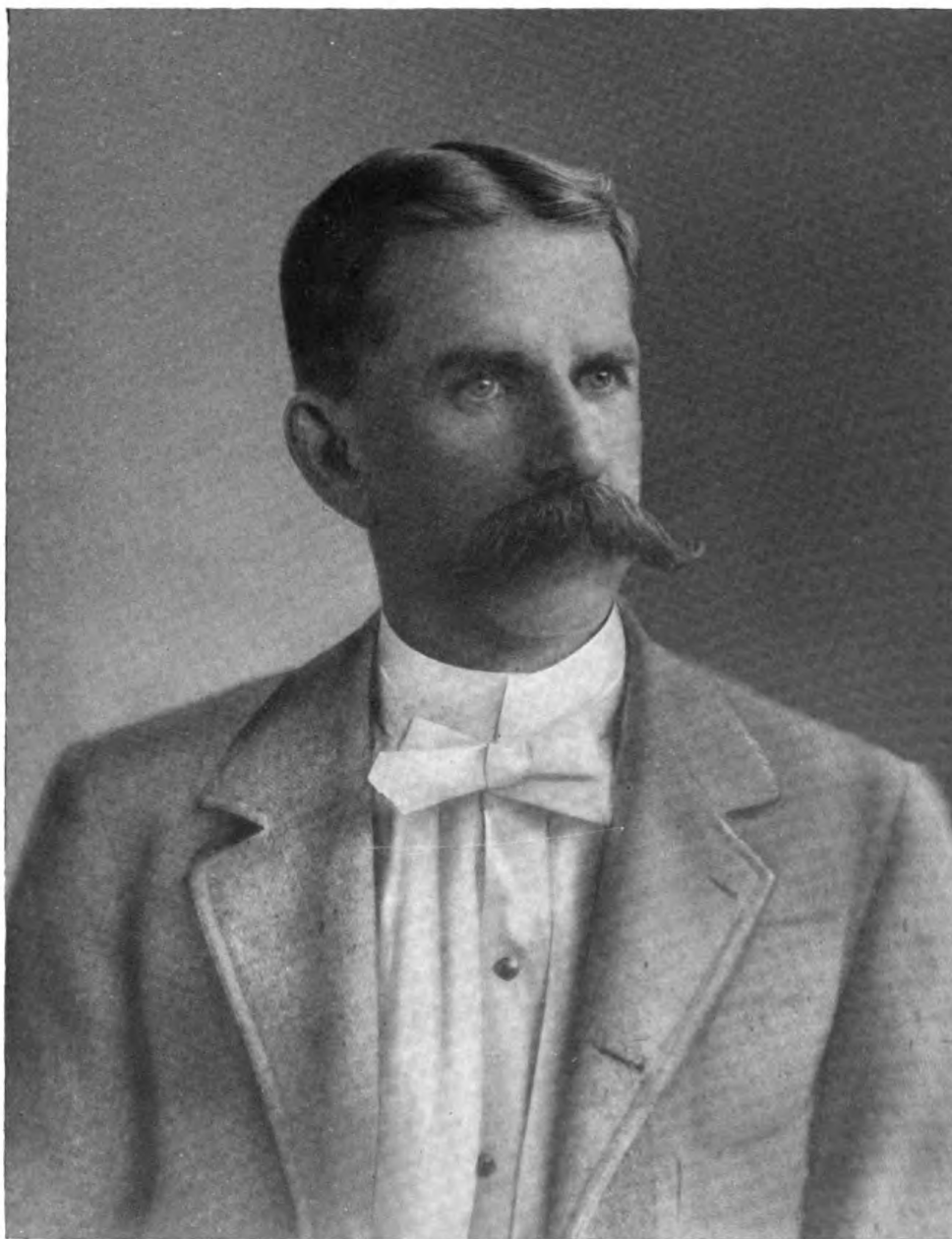
**OBSERVATIONS ON HUMAN LEPROSY: INFECTION OF RATS
WITH HUMAN EXCRETAL ORGANS**

Author's summary.—1. Both patients with advanced leprosy and others with receding clinical manifestations pass organisms in the excreta. These organisms are in large numbers, and in the latter type of case constitute a carrier problem, which points to the necessity for laboratory and hygienic control.

2. These human excreta organisms are capable of invading the skin of rats, producing by superinvasion light internal infection. There was also in some rats evidence that partial immunity had developed.

3. Leprous blood, when haemolysed and inoculated subcutaneously, gives rise to early primary lesions in rats; this suggests its use for the early diagnosis of human leprosy.

4. Climate is considered to be of secondary importance to hygiene in the dissemination of leprosy. Solar radiation in dry areas is probably effective in destroying viability of faecal organisms evacuated on soil; wet areas and incidental vegetation afford some protection to such organisms.—FIELDING, J. W.: Observations on human leprosy; infection of rats with human excretal organisms. M. J. Australia 1: 578-585, Apr. 27, 1946.



PRESLEY M. RIXEY

Surgeon General of the Navy, 1902-10

The publication of the UNITED STATES NAVAL MEDICAL BULLETIN was begun during his term of office



W. H. Bell
Editor of Naval Medical Bulletin
April 1907 ~ April 1909

NO. 1

VOL. 1

UNITED STATES NAVAL MEDICAL BULLETIN

FOR THE
INFORMATION OF THE MEDICAL
DEPARTMENT OF THE SERVICE

LIMITED TO PROFESSIONAL MATTERS AS OBSERVED BY MEDICAL
OFFICERS AT STATIONS AND ON BOARD SHIPS IN EVERY
PART OF THE WORLD, AND PERTAINING TO THE PHYS-
ICAL WELFARE OF THE NAVAL PERSONNEL

APRIL, 1907

(ISSUED QUARTERLY)



WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

A photographic reproduction of the cover of the first issue of the U. S.
NAVAL MEDICAL BULLETIN

THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



FORTIETH ANNIVERSARY OF THE ESTABLISHMENT OF THE UNITED STATES NAVAL MEDICAL BULLETIN, APRIL 1907–APRIL 1947

Naval medicine is merely medicine applied to the problems peculiar to the naval service and to nautical life. There is no fundamental difference between medicine and surgery by the medical man in the Navy and the members of the civilian profession. The only difference is in the application of medical knowledge to the prevention and treatment of disease under the special conditions of naval and military life.

The UNITED STATES NAVAL MEDICAL BULLETIN was begun in April 1907 by Surgeon General P. M. Rixey as a journal of naval and general medicine. Matters relating to tropical and preventive medicine, new features of therapeutics, surgery, organization for battle, and the experiences of medical officers afloat and ashore were the subjects to be given prominence. The Surgeon General in the preface to the first issue states that the Medical Corps as a whole will profit by the experience of the individual. This is, of course, particularly true when the opportunity for experience is so varied as is the case with the naval surgeon. The early numbers of the BULLETIN were rich in tropical medicine. The pioneer work of the Medical Department of the Navy in tropical medicine has not received sufficient recognition. For many years the BULLETIN was practically the only journal in the United States in which any considerable amount of material on tropical medicine was printed. Here, too, are first seen the names of Stitt, Butler, and Holcomb, all distinguished names in the development of tropical medicine in this country.

The first number of the BULLETIN contained 53 pages. A copy of the first table of contents is reproduced here as a matter of special interest on the occasion of the anniversary of 40 years of continual publication.

TABLE OF CONTENTS

	Page
Preface	VII
Special articles.....	1
The Gross Pathology of Samoa, with comments upon sanitary features and treatment. By A. M. Fauntleroy.....	1
A petition from Samoa.....	14
A Preliminary Report on Flagellates; their Significance and Cultivation. By H. W. Smith.....	14
A case of Tropical Febrile Splenomegaly. By H. W. Smith.....	22
Clinical notes.....	27
Tinea Tropica Circinata. By G. F. Freeman.....	27
Dengue and Influenza in the Tropics; a method of differential diagnosis. By E. R. Stitt.....	30
A Case of Aneurism of the Abdominal Aorta. By H. A. May.....	33
A Case of Adams-Stokes Disease. By P. T. Dessez.....	39
Current comment.....	41
Medical Department organization for battle.....	41
Medical progress.....	42
Laboratory—United States Navy blood stain; typhoid emulsion; a new modification of the Romonowski stain.....	42
Bacteriology—The question of supersensitization.....	47
Tropical medicine—Mode of infection in dracontiasis; trypanosomiasis; dengue.....	47
Surgery—Methods of suturing the abdominal wall; gonorrheal joint disease; cardiovascular regulation; subdeltoid bursitis.....	48

It is interesting to note that the name of Assistant Surgeon H. W. Smith, later to become a rear admiral and during World War II in charge of the Research Division of the Bureau, appears twice in the first number of the BULLETIN.

Admiral Rixey was one of the most able and farsighted medical officers to hold the office of Surgeon General of the Navy. In his regime was established the Naval Medical School (1902). He began the training of medical officers in specialities and first sent medical officers abroad for courses in tropical medicine. The Nurse Corps (female) was established (1908). The first special hospital of the Navy, the U. S. Naval Hospital, Las Animas, Colo., for the cure of tuberculosis, was built in 1906. The first naval hospitals overseas, Canacao, P. I. (1903) and Guam, M. I. (1910) were commissioned. He also established our first naval medical supply depots, those at Brooklyn, Mare Island, and Cavite, P. I. The founding of the NAVAL MEDICAL BULLETIN, the first journal of naval medicine to be published in the Americas, was not the least of these achievements.

The circulation of the first number of the BULLETIN cannot now be determined with absolute accuracy. It is believed to have been 300 copies. This is in marked contrast with the present circulation of 25,000 copies which gives it the second largest circulation of any long-established medical journal in the United States, being exceeded only by the Journal of the American Medical Association.

EDITORS AND ASSISTANT EDITORS OF THE UNITED STATES NAVAL MEDICAL BULLETIN, 1907-1947

The following is a list of the editors and assistant editors of the Bulletin since its beginning with the April 1907 number to April 1947. The dates during which they occupied the editorial chair and wielded the editorial pencil, scissors, and paste brush are also given. One held the post twice, another three times.

Surg. W. H. Bell, U. S. N----- Editor, Apr. 1907-Apr. 1909.
 Surg. C. N. Fiske, U. S. N----- Editor, July 1909-July 1910.
 Surg. J. C. Pryor, U. S. N----- Editor, Oct. 1910-Oct. 1911.
 Passed Asst. Surg. R. W. McDowell, U. S. N-- Asst. Editor, Apr. 1911-Oct. 1911.
 Surg. T. W. Richards, U. S. N----- Editor, Jan. 1912-Jan. 1914.
 Surg. J. L. Nelson, U. S. N----- Asst. Editor, Jan. 1912-Apr. 1913.
 Passed Asst. Surg. L. W. Johnson, U. S. N--- Asst. Editor, July 1913-Jan. 1914.
 Passed Asst. Surg. W. E. Eaton, U. S. N-- Asst. Editor, July 1914-Sept. 1914.
 Passed Asst. Surg. R. C. Ransdell, U. S. N--- Editor, Jan. 1915-Apr. 1917.
 Capt. J. S. Taylor (MC), U. S. N----- Editor, July 1917-July 1921.
 Lt. Comdr. W. M. Kerr (MC), U. S. N--- Editor, Oct. 1921-Mar. 1925.
 Comdr. L. Sheldon, Jr. (MC), U. S. N---- Editor, Apr. 1925-Jan. 1929.
 Lt. Comdr. R. P. Parsons (MC), U. S. N- Editor, Apr. 1929-Oct. 1931.
 Lt. Comdr. J. Harper (MC), U. S. N----- Editor, Jan. 1932-July 1933.
 Comdr. L. H. Roddis (MC), U. S. N----- Editor, Oct. 1933-Apr. 1937.
 Comdr. E. E. Smith (MC), U. S. N----- Editor, July 1937-Apr. 1941.
 Capt. L. H. Roddis (MC), U. S. N----- Editor, July 1941-Oct. 1942.
 Lt. Comdr. H. W. Rose (MC), U. S. N--- Asst. Editor, July 1941-Oct. 1942.
 Comdr. R. C. Ransdell (MC), U. S. N. R-- Editor, Oct. 1942-Feb. 1946.
 Comdr. S. A. Ziemann (MC), U. S. N. R-- Asst. Editor, July 1943-Nov. 1945.
 Capt. L. H. Roddis (MC), U. S. N----- Editor, Feb. 14, 1946-
 Comdr. N. L. Saunders (HC), U. S. N---- Asst. Editor, Feb. 14, 1946-Jan. 1947.

Excellent professional background and some measure of literary inclination and abilities are almost necessary for this post, which has always been regarded as a position of special distinction in the Medical Corps. Of the 21 medical officers who have held the position of editor or assistant editor, 5, W. H. Bell, J. C. Pryor, L. W. Johnson, L. Sheldon, Jr., and J. Harper, became rear admirals; 2, T. W. Richards and L. Sheldon, Jr., were assistants to the chief of the Bureau; while all held many important and responsible positions both afloat and ashore. Two were officers in the Naval Reserve, one of whom had previously been in the Regular Navy, while another entered the Regular Navy from the Naval Reserve. Four are dead: Rear Admiral W. H. Bell, Capt. R. W. McDowell, Capt. J. S. Taylor, and Capt. E. E. Smith.



A NEW ANTIMALARIAL DRUG—PALUDRINE

Quinine, the great specific drug for malaria, has now a long train of competitors in the various synthetic antimalarial agents of which quinacrin (atabrine) was the first of real value. One of the newest is paludrine, produced by the British investigators, Curd, Davey, and Rose. It is a pyrimidine derivative and affects the parasite in the plasma and outside the red cells. This, the exo-erythrocytic phase, is the most desirable point of attack. Extensive studies were made on avian malaria and the Liverpool School of Tropical Medicine made many studies on human patients.

The drug is a colorless powder, only slightly bitter in taste. It is given twice daily by mouth in tablet form. Dosages of more than 10 milligrams twice a day brought about clinical relief from all symptoms. Fluids are given freely. Patients at rest tolerated the drug better than those employed in work.

The most remarkable feature of paludrine (it is referred to also as M4888) is the lack of toxicity with therapeutic dosage. The range between the apparently effective daily dose and a daily toxic dose is almost 50 times in some cases. Doses of 1 gram produced nausea and vomiting.

It would seem that this is one more drug even more effective than quinine that has been developed against malaria, the "Captain of the Army of Death," among tropical diseases.



THE POWER OF PUNCTUATION

In the preparation of medical and scientific articles for publication authors are often troubled by the problems of punctuation. A few notes from an editor on the subject are, therefore, not amiss and may be helpful. In general, punctuation is overdone. Usually, if an article is held up and well shaken so that a shower of commas descends from it, the punctuation is greatly improved. Still, punctuation is important.

It was Oscar Wilde who, in writing a poem, spent a morning in putting in a comma and all afternoon taking it out. While such

perfectionism is not needed, the effects of a few punctuation marks on the meaning of a phrase is well shown by these examples:

Slow—Men Working

Slow Men Working

Slow Men—Working

Women's Ready To Wear Clothes

Women Ready to Wear Clothes

Women Ready—To Wear Clothes

Women Ready To Wear—Clothes?

Women—Ready To Wear Clothes!

There is the story of the rather eccentric English author of the last century who wrote a book and the reviewers severely criticized his punctuation. He wrote a second book and put no punctuation marks in the text, but in the back had an appendix with many pages of commas, periods, and other punctuation marks, and with a note to the effect that because of the former criticism he had put all the punctuation marks in the back of the book and the reader could take them and put them where he —— pleased. The medical writer need not go to this extreme. However, parsimony is to be encouraged.

Common sense is just as necessary in punctuation as in everything else. There are certain marks in which the rule is definite as for a period at the end of a sentence, use of the possessive, and a number of others. But in the use of commas, semicolons, dashes, and other devices for subdividing a sentence, what the author wants to say and how he wishes to express it affect the punctuation. Here the author must exercise judgment in the placing of the marks to give the effect he desires, and it is here that taste, a sense of literary propriety, and a knowledge of what constitutes good usage among English writers is necessary. A mere knowledge of rules is not enough.



CLINICAL NOTES



PRIMARY ADENOCARCINOMA OF THE APPENDIX WITH DEVELOPMENT OF MUCUS FISTULA

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and

CLARENCE G. GLENN
Lieutenant, junior grade (MC) U. S. N. R.

The following case of primary papillary adenocarcinoma of the appendix is reported because of the unusual nature of the lesion and its complications. The carcinoma caused acute appendicitis with perforation, and the subsequent development of a mucus fistula. These complications made it necessary to remove the carcinoma while it was still in a relatively early stage of development.

A review of the literature reveals very few authentic cases of adenocarcinoma arising in the appendix. A report of only one unquestionable case of adenocarcinoma still confined to the mucosa and submucosa of the appendix was found (1). The other cases were not discovered until the adenocarcinoma had metastasized or had invaded the muscularis or adjacent structures.

Two cases of carcinoma of the appendix with fistulous tract formation have been reported. Neither of these, however, was a mucus fistula. Beger (2) in 1882, reported the case of a 47-year-old male who developed an abdominal fistula from the appendix following incision of an abscess in the right inguinal region. It was found at operation that the patient had an extensive carcinoma involving the appendix. Elting (3) in 1903 reported a similar case in a 19-year-old boy. Following incision of an abscess in the right lower quadrant of the abdomen, the patient developed an abdominal fistula which never healed. At operation a carcinoma was found to have metastasized extensively from the appendix to the intestine. In both of these cases the fistulas drained purulent material.

Case report.—A 48-year-old veteran was admitted to the hospital complaining of abdominal pain of 36 hours' duration. The pain had come on suddenly. At first it was localized to the epigastrium and was not severe. Thirty-six hours later the pain was severe and had shifted to the lower abdomen, especially the right lower quadrant.

Examination revealed tenderness in the right lower abdominal quadrant. The white blood count was 13,000 with 89 percent polymorphonuclear cells and 11 percent lymphocytes. Rectal examination and urinalysis both yielded negative findings.

A diagnosis of acute appendicitis was made and operation was advised. A McBurney incision was made, and upon opening the peritoneum, cloudy free fluid was encountered. A firm mass, about 2 inches in diameter, was palpable in the region of the cecum. It was thought that this represented a walled-off appendiceal abscess, and no attempt was made to find or remove the appendix. A drain was placed in the lateral gutter, and the wound was packed open.

The wound drained pus for several weeks, but finally healed except for a small sinus tract which drained clear fluid. The patient was discharged 7 weeks after operation, with a persistent draining sinus tract, and was advised to return in 3 months for an interval appendectomy. At the time of discharge the patient's general condition was excellent.

One month later the patient returned to the hospital with the sinus at the site of the McBurney incision still draining a clear mucoid fluid. Analysis of this fluid revealed that it was mucus. Twelve weeks after the first operation the old scar was excised and the sinus tract followed down to the appendix, which was firmly bound to the mesentery of the ileum. At its distal end the appendix was distended to about 4½ cm. The appendix was ligated and removed 1.5 cm. proximal to the tumefaction.

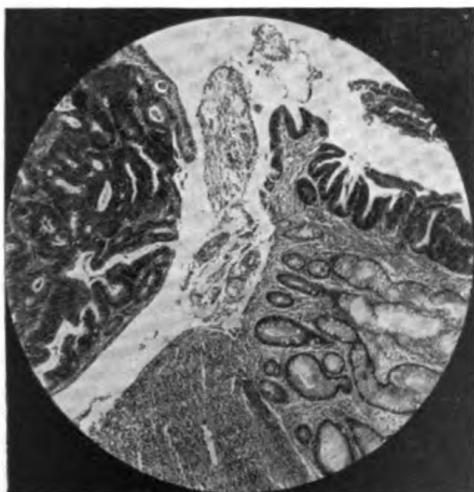


FIGURE 2.—Section of appendix showing contrast between normal mucosa and adenocarcinoma.

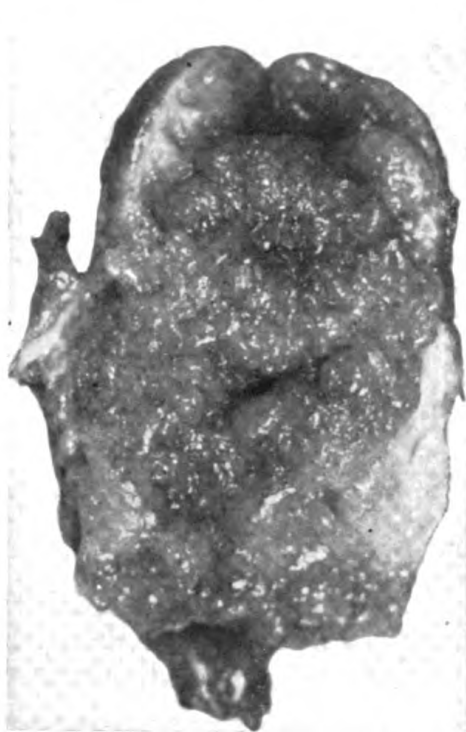


FIGURE 1.—Gross specimen of opened appendix showing the adenocarcinoma. Note normal mucosa at both ends of appendix.

Gross examination of the appendix after it was opened revealed what apparently was a polypoid cauliflower-like epithelial tumor. Short segments of mucosa at the proximal and distal ends were not involved (fig. 1). Microscopic examination showed the tumor to be papillary adenocarcinoma, Grade I. The tumor did not invade the muscular layers of the appendix (fig. 2).

The patient made an uneventful re-

covery with no recurrence of the fistula. At the present time, 3 months after operation, he is free from symptoms.

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HEMORRHAGIC ULCERATIVE GASTROJEJUNITIS THIRTY YEARS AFTER GASTRO-ENTEROS- TOMY FOR CONGENITAL PYLORIC STENOSIS

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and

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Captain (MC) U.S.N.R.

This is a case report of a 30-year-old naval officer who had several hemorrhages from the gastro-intestinal tract. These hemorrhages were from the side of a gastro-enteric stoma which had been made when the patient was an infant because of congenital pyloric stenosis. In this case, as well as in four others reported by Walters (4) various degrees of hemorrhagic gastrojejunitis were present at the time the gastro-enteric anastomosis was removed and partial gastrectomy was performed.

Three of these five patients have had no further evidence of gastro-intestinal hemorrhages. Two, after being free of hemorrhages for several years, had one hemorrhage each following an episode of irritation of the gastric mucosa, as the result of overindulgence in alcoholic drinks. With the elimination of alcohol and nicotine neither patient has had further bleeding.

Two other cases of somewhat similar type have been reported by Fowler and Hanson (1) and by Stevens and Boeck (2). In both of these cases, after the removal of the gastro-enteric anastomosis, excision of the jejunal ulcer and the closure of the jejunum, pyloro-

¹ At the time this article was written Dr. Walters was on leave of absence from the Division of Surgery, Mayo Clinic, Rochester, Minn.

plasties were performed. Both patients were well 1½ years following the operations. Stevens and Boeck called attention to the fact that gastroscopic examination of their patient revealed nothing of significance on occasions in the intervals between hemorrhages. It appears, therefore, that the inflammation and ulceration occur intermittently and that the episodes of healing are only temporary.

The following case is presented in detail because of its interest from the standpoint of the fact that hemorrhagic gastrojejunal ulceration did not occur until the patient was 30 years old, and that pathologic examination of the resected portion of the stomach, including the pylorus, showed hypertrophy of the pyloric end of the stomach to the extent that pyloric obstruction was still present.

CASE REPORT

In April 1943, while on active duty in the Navy, the patient had a severe intestinal hemorrhage. He had tarry stools for a period of 1 week. The erythrocyte count dropped to 1,200,000 per cubic millimeter and the concentration of hemoglobin to 37 percent. Following treatment for anemia the patient stated that studies were done "which did not reveal the cause of the hemorrhage." He took a bland diet for 6 months and there were no further tarry stools. At no time had he had pain or vomiting.

On 23 August 1945 the patient entered the U. S. Naval Hospital at Alea Heights. He gave a history of again having noted tarry stools without other symptoms. He was suspected of having a recurring gastrojejunal ulcer and was put on medical regimen for ulcer. A report of the roentgenologic studies is not obtainable, but the patient said that a diagnosis of hernia of the stomach was made.

On 1 October 1945 the patient was evacuated to the United States and entered the U. S. Naval Hospital at Philadelphia on 18 November 1945. At this time his general condition was satisfactory and nothing abnormal was found in his physical examination. Blood pressure was 110 mm. of mercury systolic and 72 diastolic. The heart was normal. There was a right upper rectus scar on the abdomen which was well healed. The patient brought reports of roentgenologic studies which revealed malfunctioning gastro-enterostomy with dilatation of the proximal loop with a peculiar pouch formation. He also stated that findings after a barium enema and on sigmoidoscopic examination were not abnormal. An analysis of the gastric contents revealed no hyperacidity.

At operation on 19 November 1945 the gastro-entero-anastomosis was taken down, a small jejunal ulcer excised, the opening of the stomach and jejunum closed, and partial gastrectomy and partial duodenectomy performed. Half of the stomach was removed. A Billroth I (von Haberer) anastomosis of the end of the stomach to the end of the duodenum was performed. The distal loop of jejunum was adherent to the anterior portion of the anastomosis and probably gave the appearance of a proximal loop in the roentgenogram. The proximal loop of jejunum forming the anastomosis was not appreciably long nor was it appreciably dilated. There was a scar in the jejunum suggestive of a healed jejunal ulcer which was located about 1.5 cm. beyond the anastomosis. At the site of the anastomosis, there was some evidence of gastrojejunitis and in one place on the anterior wall there appeared to be a small ulcer. The jejunum was detached from the stomach and the region of ulceration and scar was removed. The opening in the jejunum was closed transversely and the opening of the

stomach was closed. The lower half of the stomach was removed, with it the hypertrophied pyloric sphincter which was about 3 to 4 times normal thickness. The end of the stomach was sutured into the end of the duodenum and the posterior wall and angles of the anastomosis were protected with omentum. No stones could be felt in the gallbladder which emptied readily.

The operation was done with the patient under general anesthesia with ether, nitrous oxide, and oxygen. A Levine tube was inserted through the nose to the stomach prior to the operation and left in after operation and suction was applied. The patient was given 3,000 cc. of fluids intravenously; 2,000 cc. of which was 5 percent dextrose in distilled water and 1,000 cc. of physiologic saline solution. On the third day after operation the Levine tube was removed and he was taking food by mouth. Convalescence was uneventful and he was discharged from the naval hospital on 5 December 1945. Prior to his dismissal a study of his gastric acidity by the fractional method revealed total acidity of 25, 30, 30, and 35, free hydrochloric acid of 0, 0, 0, 0, and 40, 15, 15, and 15 of gastric contents 60, 75, and 90 cc. 105 minutes after a test meal.

The pathologic report on the pyloric portion of the stomach by Commander H. R. Fisher was as follows: The section through the pylorus exhibited marked thickening of the submucosal fibrous tissue just proximal to the duodenum. The duodenal mucosa was heavily infiltrated with lymphocytes and plasma cells. The intramuscular elements were hypertrophied but in one section examined there was no evidence of extension of scar tissue through the muscularis. Another section through the same region exhibited edematous fibrosis of the submucosa and mucosa in which there was a general sprinkling of chronic inflammatory cells.

SUMMARY AND COMMENT

The case of a naval officer who had ulcerative hemorrhagic gastro-jejunitis is reported. Gastro-enterostomy had been performed 30 years previously for congenital pyloric stenosis.

The gastro-enteric anastomosis was removed, the region of inflammation excised, the opening in the jejunum closed and partial gastrectomy performed. A Billroth I (von Haberer) anastomosis between the upper end of the stomach and the duodenum restored gastrointestinal continuity.

In the von Haberer modification of the Billroth I, the entire circumference of the stomach is sutured to the circumference of the duodenum, the additional size of the former is reduced by interrupted reefing sutures (3).

This is the fifth case of this type in which one of the authors has performed operation. Two cases have been reported by others. Excellent results were obtained from the partial gastrectomy in this case.

The pyloric obstruction continued with demonstrable hypertrophy of the structures of the pylorus.

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RAT-BITE FEVER

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Rat-bite fever is an acute infectious disease usually contracted from the bite of a wild rat. Cases have been reported from all parts of the world, but most commonly from Japan where house construction favors close association between rats and people.

The causative organism enters the bite wound at the time of the bite; *Spirillum minus* is thought to be the etiological organism in true rat-bite fever, although cases clinically similar have occurred in which the *Streptobacillus moniliformis* has been established as the causative agent. In some cases it is not possible to demonstrate an etiological agent.

After an incubation period ranging from 5 to 40 days, during which time the wound of the rat bite heals, there is sudden onset of symptoms with headache, nausea, chills, malaise and weakness, and a sudden rise in temperature to 101°-102° F. With the appearance of these systemic symptoms, or just prior to it, the site of the original bite becomes inflamed, with surrounding edema; necrosis and vesicle formation may occur and there is swelling and tenderness of the regional lymph nodes. Shortly after the onset a characteristic purplish, maculopapular skin eruption usually appears on the legs, arms, and trunk, and severe muscle and joint pains may occur. A leukocytosis of 15,000 to 20,000, usually with an eosinophilia, occurs.

In 2 or 3 days the fever reaches 104° F. where it remains for 2 or 3 days more, then falls rapidly to normal for 5 to 9 days during which time the local lesion and swelling usually subside. If untreated, or in cases not responding properly to treatment, there will then follow a series of febrile relapses, resembling the relapsing fevers, extending over a period of several months.

The mortality in untreated cases is less than 10 percent. Neoarsphenamine has been the accepted treatment and one or two doses of 0.3 to 0.6 gm. each will usually cure cases due to the *Spirillum minus*, but apparently has no effect on cases due to the *Streptobacillus moniliformis*. Recently penicillin has been tried experimentally and clinically and has been shown to be effective against both organisms.

Following is the report of a case observed aboard this ship and diagnosed upon clinical evidence as rat-bite fever. The diagnosis was not confirmed by identification of the etiological agent.

Case report.—The patient, an 18-year-old white male, came aboard this ship from Okinawa on 12 December 1945 as a passenger. He had spent the previous 5 months on Okinawa, living in a tent under field conditions.

On 14 December 1945 he reported to the sickbay complaining of slight soreness in front of the right ear. Examination revealed a normal temperature and a slightly enlarged and tender right parotid lymph gland. There was an almost completely healed "scratch" over the right eyebrow which the patient said had been caused by the bite of a wild rat while he was asleep 4 weeks previously while on Okinawa. (He had been bitten twice previously on the fingers, the lesions healing uneventfully.) The following day there was beginning induration and brownish discoloration of the supra-orbital rat-bite lesion. The temperature was normal and the patient felt well except for the tenderness in the right preauricular region.

On 16 December 1945 he returned feeling acutely ill, with marked anorexia, several chills during the preceding night, weakness, and general malaise. The patient looked acutely ill and somewhat apathetic and had a temperature of 102° F. The supra-orbital lesion appeared necrotic, was definitely larger (about 1 cm. in diameter), dark reddish-brown in color, indurated and with a dry surface. There was a slight surrounding area of induration, and marked edema extending down the right side of the face. There was tenderness of the lesion, of the right parotid lymph glands, and of the cervical lymph glands at the angle of the right jaw which were also enlarged. The remainder of the examination was normal.

The patient was admitted and a laboratory work-up showed the following:

Urinalysis: Color, amber; reaction, slightly acid; specific gravity, 1.022; sugar, negative; albumin, negative; microscopic, 6 to 8 white blood cells (high power).

Blood count: Red blood cells, 4,500,000; white blood cells, 11,000; neutrophils, 58 percent; lymphocytes, 25 percent; monocytes, 4 percent; and eosinophils, 13 percent.

Kahn test, negative; blood cultures, negative; smear from lesion, negative for *Streptobacillus moniliformis*; darkfield from lesion, negative for spirilla.

NOTE.—Attempts to aspirate the lymph glands were unsuccessful.

On 17 December the patient's condition was somewhat worse. His temperature was 104.2° F. Small vesicles had appeared around the lesion and the edema had increased causing closure of the right eye. The patient was still apathetic and had refused all food for the past 2 days. On the evening of 17 December penicillin was started, intramuscularly, 50,000 units being given every 4 hours for 8 doses, then 20,000 units every 4 hours for 10 doses, a total of 600,000 units being given.



FIGURE 1.



FIGURE 2.

FIGURES 1 and 2.—Appearance of patient on fourth day of the disease. Note the large lesion at the site of the original rat bite and the unilateral edema.

Improvement was rapid; on 18 December the patient's temperature was falling and he felt well enough to eat a liquid diet. On 19 December the patient's temperature was down to 99.6° F., he felt much improved and the edema of the right side of the face was receding. On 20 December his temperature was normal, only slight edema was present and the lesion and regional lymph glands were only slightly tender. The temperature remained normal and by 25 December the patient felt entirely well. A dry eschar at the site of the lesion was accidentally knocked off, leaving a punched-out but clean granulating ulcer, which later healed uneventfully. The patient was sent to duty, and at the present time, 2 months following discharge, there has been no relapse of symptoms.

At no time during the course of the disease was a skin eruption or joint or severe muscle pains noted.



FIGURE 3.—Appearance of patient on ninth day of the disease. The edema has subsided and the lesion is healing.



FIGURE 4.—Appearance of patient 1 month after discharge. A scar is present at the site of the former lesion.

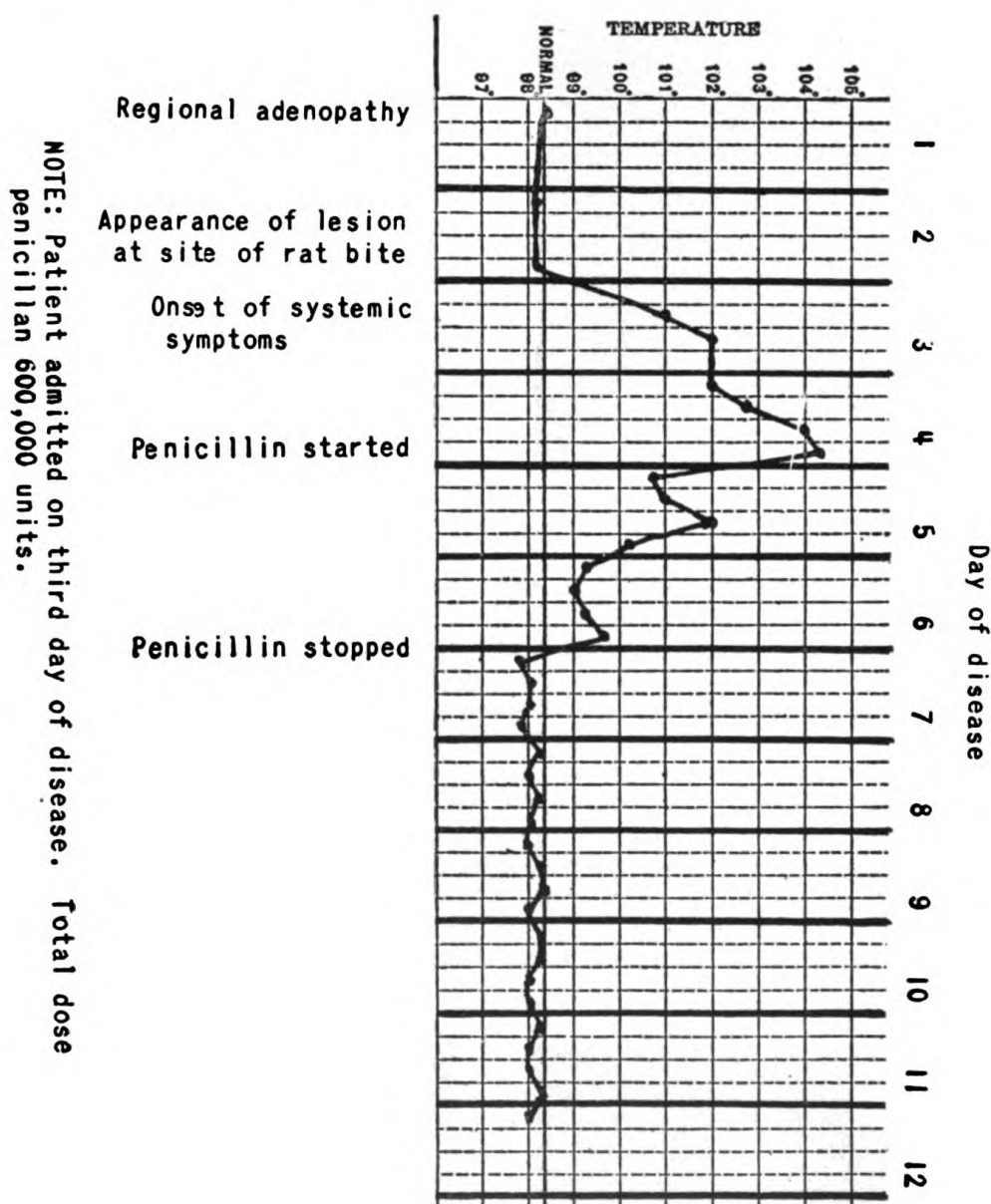


FIGURE 5.

It has been the author's observation that wild rats are quite numerous on Okinawa and constantly enter the living quarters of personnel stationed there, not infrequently molesting them in various ways. Since rat-bite fever is known to be common in Japan, it can therefore be reasonably expected that occasional cases might occur among naval personnel stationed in Japan and adjacent island chains.

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HYPERERGY TO NICOTINE

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The finding of a "bigeminal pulse" in tobacco smokers is by no means a rarity and is accepted as an almost normal response of the heart to nicotine. Its occurrence is usually disregarded by both patient and physician, but in the case reported here it became a distressing problem to the former and an interesting phenomenon to the latter.

CASE REPORT

On 9 August 1945, the patient, a 38-year-old woman came to the hospital complaining of palpitation, headache, weakness, and dizziness that had been present continuously for more than 3 months. Physical examination of the heart was normal, except for regular irregularity of the apical rhythm with a 2:1 pulse deficit. Electrocardiogram (fig. 1) confirmed the presence of a persistent "pulsus bigeminus."

After 3 weeks' trial of several drugs without effect, the rhythm was unchanged. At this time a review of the patient's habits revealed that she had begun smoking 4 months before. She was advised to stop smoking and in 2 days had no complaints. Electrocardiograms (fig. 2) taken on 9 September 1945 was normal.

At this visit the patient was given a cigarette and after 3 or 4 puffs palpitation recurred (fig. 3). Patient's symptoms persisted for 2 days after this short smoke.

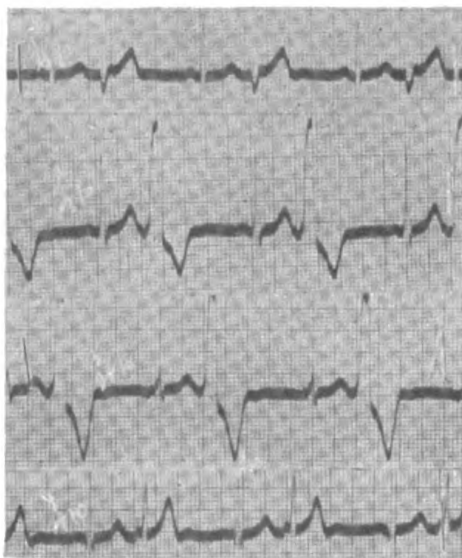


FIGURE 1.—9 August 1945. Showing ventricular premature coupling throughout.

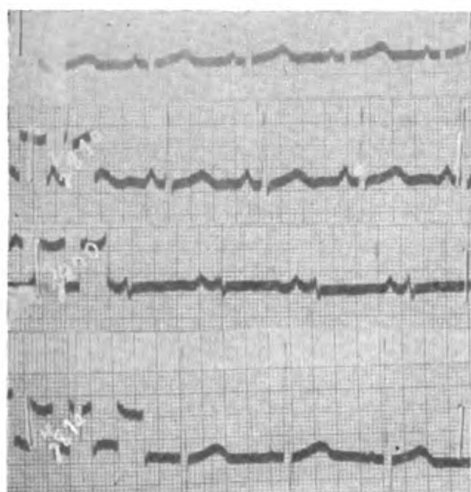


FIGURE 2.—9 September 1945. Showing normal electrocardiogram.

On 13 September 1945 the rhythm was checked by electrocardiogram and patient was then allowed to smoke 1 denicotinized cigarette, after which only 4 premature contractions occurred in a period of 15 minutes' observation. The following day she was given a cigarette and, as before, promptly developed a "pulsus bigeminus."

The patient has remained in normal rhythm since that date.

When the sensitivity was first noticed the probability of an allergy to tobacco was considered. An intradermal test and a patch test with mixed tobacco elicited no skin reaction and the patient's reaction to a denicotinized cigarette proved that the cardiac arrhythmia was due to a hyperergy to nicotine.

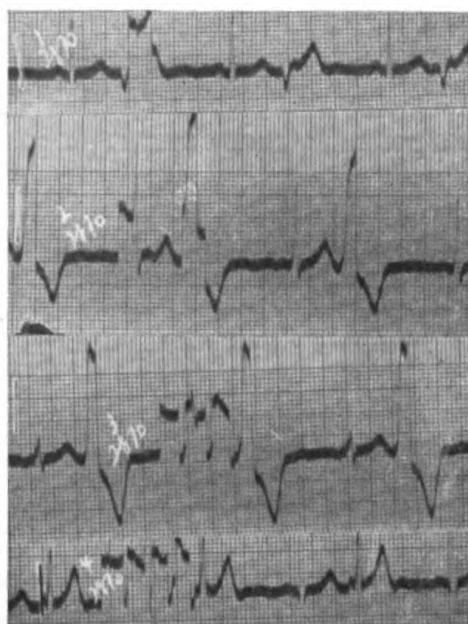


FIGURE 3.—9 September 1945. After smoking a part of one cigarette. Ventricular premature coupling throughout.



DUODENAL ULCER AND HOOKWORM INFESTATION: DIAGNOSTIC AND MILITARY MEDICO-LEGAL PROBLEM

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It is known in medical literature that severe hookworm infestation in a majority of cases shows roentgenologic changes in the duodenum. The anatomical lesion associated with ancylostomiasis shows local circumscribed hemorrhage in the intestinal wall of the small bowel, especially in the submucosa, causing thickening of the folds on the roentgenological picture.

Thus one can see how easy it is for an equivocal diagnosis to be made in a patient with a roentgenological diagnosis of duodenal ulcer and concurrent infestation with hookworm, inasmuch as he may have true duodenal ulcer with hookworm infestation or may have a hookworm duodenitis with pseudo-deformity of the duodenum. The symptoms presented by hookworm duodenitis would not differ from those of an ulcer. There may be a high-acid titer, higher even than in ulcers. Stools may be positive for occult blood, and symptomatologically the patient may have a pain-food-relief pattern. The roentgenographic picture of hookworm duodenitis or hookworm duodenal deformity does not disappear immediately after eradication of the hookworm, but requires from 4 to 6 weeks before the duodenal bulb and duodenal mucosa become normal. Yenikomshian (1) states that usually it takes from 11 to 24 days for the duodenum to return to normal after the vermifuge is administered, but it is the opinion of the author that it takes longer. It is important to have frequent roentgenological examinations at intervals of 2 to 3 weeks in order to show the steady decrease of these signs as the duodenum returns to normal.

In our three cases, two had severe hookworm infestation in addition to the ulcer; the third had only severe hookworm infestation, without duodenal ulcer.

Two cases received six courses transduodenally of hexylresorcinol and tetrachlorethylene (hexylresorcinol, 1 gm.; tetrachlorethylene, 3 cc.). One patient received only three courses before the hookworm disappeared from the stool.

CASE REPORTS

Case 1.

J. W. P., S2c, 18-year-old white male.

Diagnosis.—Ulcer, duodenum and hookworm infestation.

Chief complaint.—Epigastric pain of 2 years' duration.

Present illness.—Approximately 2 years ago, 1 year prior to entry into the Navy, this man noted bloated feeling, more marked about 2 hours after eating. This followed a heavy chest cold and dry cough, which the patient had contracted 1 month previously. This state continued in moderate degree, and increased in severity after his entry into the Navy, and progressed to a colicky type of pain in the epigastrium, relieved by food, milk, or alkalis. Starting in November 1944 the pain became more severe during the night and often caused the patient to have sleepless nights. This continued with remissions of 2 to 3 weeks, always followed by exacerbations. There was no nausea or vomiting. Finally, in April 1945 due to the persistence of complaints, this man was admitted to this activity, following an x-ray diagnosis of duodenal ulcer at his duty station.

Past History.—Patient had the "ground itch" several times during his childhood, but could not recall the exact dates of this dermatitis.

Physical examination revealed a well-developed, well-nourished, white male appearing stated age of 18. Temperature 98.2°, pulse 84, respiration 20, blood pressure 118/82. The entire physical examination revealed no abnormalities, with the exception of moderate tenderness on deep palpation of the epigastrium

to the right of the midline, the remainder of the examination being essentially negative.

X-ray reports:

22 February 1945: The duodenal cap showed constant spastic deformity with moderate degree of tenderness located along the lesser curvature side and to the base. No demonstrable niche. The roentgen findings are those of duodenal ulcer.

18 April 1945: The duodenal cap is markedly and persistently defective with marked disturbance of the rugal pattern. No definite shadow indicative of a crater can be made out.

10 August 1945: Duodenal cap shows a persistent defect.

Case 2.

E. B. Y., F2c, 32-year-old white male.

Diagnosis.—Ulcer, duodenum and hookworm infestation.

Chief complaint.—Epigastric pain intermittently of 7 years' duration.

Present illness.—Approximately 7 years ago, while a crane operator in Florida, the patient noted onset of pain in the epigastrium, nonradiating, unrelated to meals, relieved temporarily by milk or food. Six-months after onset, the pain became of such severity that the patient was incapacitated and could not fulfill duties for 1 month. At this time he received medical care from a local physician, the principal factor in his care being an ulcer diet routine. From that time until his entry into the Navy in April 1944 he had no recurrences of this pain. Three months after entering the Navy, while on board ship, the pain recurred, coming on at any time during the day and causing the patient to wake at night. Milk, food, and alkalies relieved the pain. The patient was bloated after meals, and gaseous eructations were common. The pain became increasingly severe, until this man was unable to capably carry on his duties. He was admitted to this activity in May 1945 approximately 1 year after onset of this episode.

Past history.—Patient had "ground itch" several times during childhood. Past history otherwise is negative.

Physical examination revealed a well-developed, well-nourished white male, appearing stated age of 32. Temperature 98.4°, pulse 80, respiration 18, blood pressure, 120/80. The tonsils appeared atrophic and the pharynx was slightly injected. The examination of the chest revealed no abnormality. The abdomen was firm, good muscular tone, and no spasticity, with only slight tenderness in the epigastrium to the right of the midline on deep palpation. The right inguinal canal was moderately dilated, with marked relaxation of the walls, and a heavy impulse was transmitted to the examining finger on coughing. The remainder of the physical examination was entirely negative.

X-ray reports:

4 June 1945: The duodenal cap fills and empties rapidly, and, when partially empty, reveals a concave type defect on the greater curvature side of the cap. The rugal pattern appears somewhat coarse in the cap, but no evidence of an ulcer crater is noted.

19 July 1945: Gastro-intestinal series shows a similar concavity on the inferior surface of the duodenal cap near the base.

Case 3

G. K. S., S1c, 20-year old white male.

Diagnosis.—Hookworm infestation.

Chief complaint.—Epigastric pain of 3 months' duration.

Present illness.—This man, while serving overseas in the Mediterranean Theatre in November 1944 noted the onset of a "heavy cold" and a dry cough that lasted for about 1 month. During this time he became weak and nervous, and appetite decreased considerably. After meals the man felt bloated, and gaseous eructations were frequent. In January 1945 the patient returned to this country, and his symptoms of lassitude and weakness increased, and palpitation was an annoying symptom, as well as nervousness, which had heretofore been foreign to this man. After returning to this country, sharp pains in the epigastrium became a very persistent and troublesome complaint. The pains would come on at various times of the day, occasionally radiating to the left scapula, and were relieved temporarily by milk or alkalies, but not by food. Fried foods aggravated this pain. The weakness increased to the point of incapacitation. He was admitted to this activity in April 1945 after an x-ray taken at his duty station was interpreted as revealing a healed duodenal ulcer. There had been a 20-pound weight loss since the onset.

Past history.—With the exception of hospitalization for acute tonsillitis in 1942 and for gonorrhea in Naples in June 1944 the past history is noneventful.

Physical examination revealed a well-developed, well-nourished, white male, appearing stated age of 20. Temperature 98.0°, pulse 80, respiration 20, blood pressure 110/70. The tonsils were moderately enlarged and the mucous membranes were pale. The head and neck were otherwise negative. The lungs were clear to auscultation and percussion, and the heart presented no abnormalities. The abdomen was flat and muscular, and moderate tenderness was elicited by deep palpation over the epigastrium to the right of the midline, with minimal voluntary rigidity. The remainder of the physical examination was completely negative.

X-Ray Reports:

29 April 1945: The duodenal cap was neither irritable nor tender, but showed persistent deformity. Impression: Healed or healing duodenal ulcer.

7 May 1945: The folds of the duodenal cap are thickened and there was compression of these folds along the greater curvature. Impression: Findings of the duodenal cap are nonspecific and may represent a healed ulcer.

7 July 1945: Re-examination of the duodenal bulb shows a persistent slight deformity along its greater curvature without irritability or tenderness.

17 August 1945: The duodenal bulb is essentially normal. No defect is visible. The mucosal pattern of the bulb is coarsened, but there is no crater.

COMMENTS

It is important in our Southern States, especially in those where hookworm is prevalent, that the search for parasites in stool examinations should be sine qua non of any gastro-intestinal study. It is noted that it took in some cases a period of up to 4 months' hospitalization before the ultimate correct diagnosis was established and before the hookworm was eradicated. Occasionally hookworm infestation is very difficult to get rid of, and only persistence in vermifuge administration will clarify both the roentgenological picture and symptomatology of the patient.

SUMMARY

1. Hookworm infestation can simulate duodenal ulcer or duodenitis.
2. After complete disappearance of the hookworm ova from the stools, roentgenological studies of the duodenal cap should be continued from 4 to 6 weeks later, to be certain that there is no concurrent duodenal ulcer present.
3. Pensions are paid to ulcer cases where disability exists, so correct diagnosis is important.

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MEDICAL AND SURGICAL DEVICES



USE OF WANGENSTEEN SUCTION ABOARD SHIP

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The purpose of this article is to present a simple apparatus that can be quickly assembled from materials aboard ship and that will provide a maximum of decompression with a minimum of supervision. It is felt that it will be of greatest value to the pharmacist's mate on independent duty who often is called upon to treat conservatively intra-abdominal lesions that would ordinarily be treated surgically if a medical officer was available. An example is acute appendicitis where Wangensteen suction may often be the determining factor in the successful use of conservative therapy. Pharmacist's mates aboard Merchant Marine vessels, trained in the use of this apparatus at the U. S. Marine Hospital, San Francisco, Calif., have reported the successful use of suction on several occasions. It has been found useful in the treatment of intractable vomiting due to motion sickness as well as in alcoholic gastritis with lavage.

The use of Wangensteen suction requires a knowledge of its indications and of material available to maintain an adequate water balance. Both should be possessed by the rated pharmacist's mate. It is better to overuse suction than to neglect it. The success of conservative treatment of penetrating wounds of the abdomen and ruptured viscera largely depends upon the establishment of early and continuous suction. Intravenous fluids are often unavailable or exhausted early. For this reason all pharmacist's mates should be acquainted with the use of proctoclysis—which has become almost a lost art. The authors have maintained a urinary output in excess of 1,500 cc. by using a continuous proctoclysis as the only source of fluid in conjunction with continuous suction.

Needless to say no claim for originality is made. The material and set-up is essentially those of the original Wangensteen apparatus.



FIGURE 1.

Thirlby¹ presented an apparatus which could be constructed quickly and easily in an emergency for use at outlying naval dispensaries, the principle of which could be used aboard ship. No other reports of the apparatus were found in a limited review of the literature.

The apparatus described in the article was first used aboard ship by one of the authors (C. J. W.) in 1943. As pictured (figs. 1 and 2), the apparatus consists of three 1-gallon bottles fitted with two-hole rubber stoppers. Where rubber stoppers are not available the carpenter's shop can easily turn out wooden stoppers machined to fit snugly and the seal is completed with balsam of Peru or heavy petrolatum.

¹ THIRLBY, R. L.: Improved Wangenstein suction apparatus. U. S. Nav. M. Bull. 42: 1419-1420, June 1944.

When these are used they should be held in place with tape to prevent their displacement upon inverting the bottle. One bottle (*A*) is secured to the deck or bunk and acts as a collecting bottle, thus avoiding contamination of the system. Another bottle (*B*) is secured to the

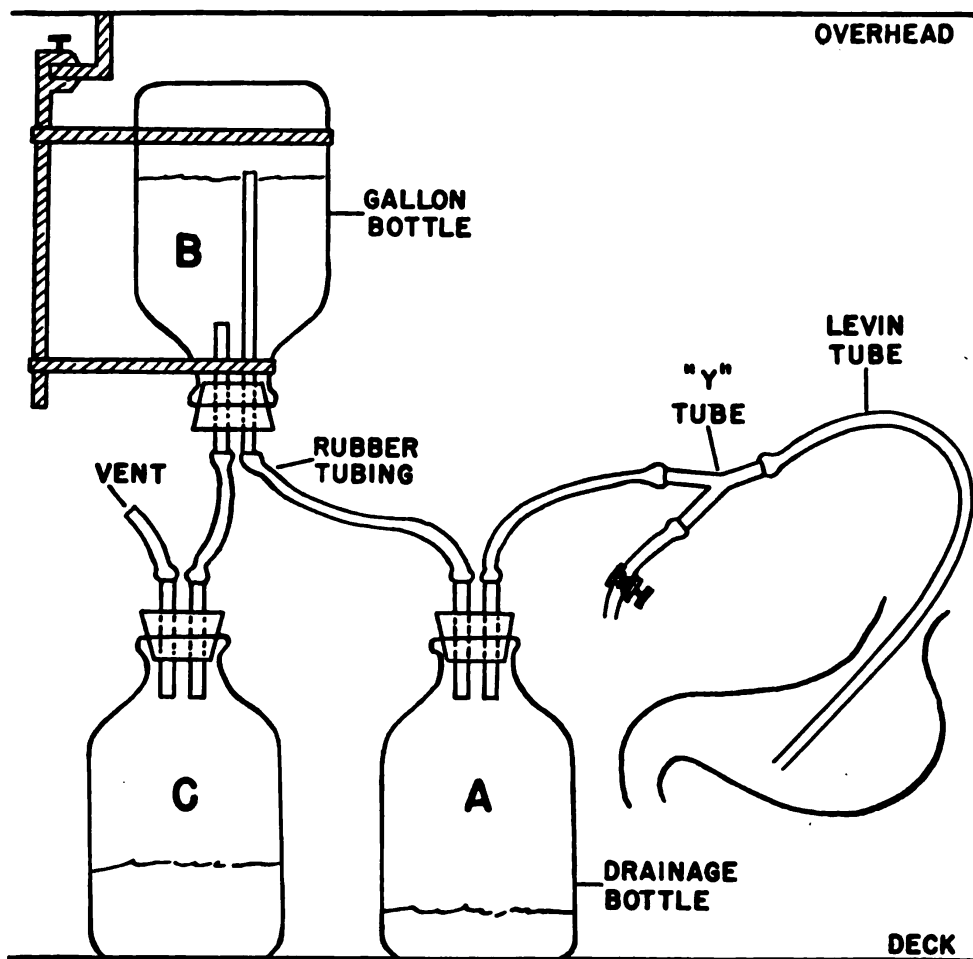


FIGURE 2.

Equipment

- | | |
|------------------------|--|
| 1. Gallon bottles (3). | 5. Rubber stoppers (3) with two holes. |
| 2. Levin tube. | 6. Rubber tubing. |
| 3. Glass tubing. | 7. Tubing clamps. |
| 4. Glass Y-tube. | |

Directions

1. Bottle *A* is secured to bunk and connected to Levin tube (leading to stomach) by glass Y-tube.
2. Bottle *B* is secured to overhead and connected to bottles *A* and *C* by rubber tubing.
3. Bottle *A* acts as a collecting bottle of stomach secretions and prevents contamination of water in bottles *B* and *C*.
4. All connections must be airtight.

overhead in a manner that will allow its easy removal. This may be accomplished by a simple twine sling or with tape, but the bottle must be secure to avoid much movement as the ship rolls. A removable metal sling is very satisfactory and can be quickly constructed aboard ship. The third bottle (*C*) is secured to the deck. Connections must be airtight. In operation, the water running from bottle *B* to bottle *C* reduces the pressure in bottle *A* which is in turn referred to the Levin or Miller-Abbott tube. When the water has run low in the upper bottle, bottles *B* and *C* are reversed. A glass Y-tube is interposed between the Levin tube and the collecting bottle to allow irrigation, etc. In the event glass tubing is not available, metal tubing may be substituted as it is always stocked aboard ship for the repair of refrigeration units. Soft rubber tubing may be reinforced by wrapping it with shellaced twine.

SUMMARY

A simple suction apparatus is described, primarily for the information of enlisted medical personnel who may be called upon to institute conservative therapy in cases of intra-abdominal lesions. It also will be of value to the ship's surgeon postoperatively where suction is indicated. No attempt was made to discuss the indications for Wangensteen suction as these are adequately covered in most texts.

BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

HARVEY CUSHING—A BIOGRAPHY, by *John F. Fulton*, M. D. 754 pages; numerous illustrations. Charles C. Thomas, Springfield, Ill., publisher, 1946. Price \$5.

In 1926 Harvey Cushing received the Pulitzer Prize for his *Life of Osler*. Now that Pulitzer Prize winner is himself the subject of a book, which is deserving of that distinction. This opening statement is a preview of the excellence of this volume.

Dr. Fulton, who is Sterling Professor of Physiology at Yale, is peculiarly fitted for his task. Like Cushing himself he is a distinguished physician, scholar, bibliophile, and bibliographer. His sympathetic understanding of his subject is heightened by having been pupil and friend. He has also had all the sources of information placed at his disposal by Dr. Cushing's family. These source materials were unusually rich. Cushing was an inveterate diarist. He came to know everyone of eminence in medicine, not only in America but in Europe, and his scholarship and personality carried him far outside the usual professional fields for friendships. His letters therefore are numerous and he was a delightful letter writer.

Dr. Fulton described well the picture of Cushing's many achievements. He was not only a great pioneer in brain surgery; he was a great teacher and a leader in the advance of medical education in this country. He brought up a generation of young neurosurgeons who looked to him as their master. His work on the pituitary is one of the classics of medicine. As has been said, he was a Pulitzer Prize winner, and he possessed great gifts as an artist. He did much for the recognition of medical history and he was probably the country's leading medical bibliophile.

Not the least interesting are the glimpses of his personality. There is the whimsical character of the title for a paper to be read at a meeting on medical history. "Who put the fox in foxglove?" his graphic description of the illness and household of Sir Henry Head; and there is an anecdote of his teaching his daughter's spaniel to jump up on the piano bench and strike several notes with his forepaws when Dr. Cushing would refer to him as "Mr. Paderewski" and ask for a little music.

The illustrations, many of them copies of Cushing's own work and showing his talents as a graphic artist, are a notable feature, and the appearance and binding of the book are attractive and dignified.

THEIR MOTHERS' SONS, by *Edward A. Strecker, M. D., Sc. D., Litt. D., Professor of Psychology, University of Pennsylvania*. 220 pages. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1946. Price \$2.75.

Dr. Strecker is one of the select few who is likely to add a new word to our language. This word is "Momism." By this is meant oversolicitude and dominance over the lives of children, although "Momism" can also extend to the husband and father, and to other relatives.

Dr. Strecker's indictment of the "Moms" of America is a devastating one. He charges in effect that the vast number of psychoneurotics which the war revealed in our Armed Forces was largely due to the frustrations, the immaturity, and the emotional instability which resulted from this feminine control. It is no hastily considered or baseless charge. He lays the facts on the line and produces the unmistakable evidence. He not only indicts the mothers of America, he proves the charge against them. There is no use either of blaming it on the war, because the war was not the cause. It merely revealed a condition which existed and which has profound influences in civilian life as much as in military life.

The author, who is one of the country's leading psychiatrists and speaks with authority, has written a book that is as simple and clear as a first reader. He has taken the \$64 words of psychiatry and translated them into words of one syllable, which anyone may read and understand. One of the best chapters is his classifications of "Moms." He describes 7 basic types and we have all seen them. In order not to leave "Moms" all alone, however, Dr. Strecker also has a chapter on the "Moms" in pants, which points out the paradoxical fact that fathers also can be the worse types of mothers.

The writer does not view the situation with alarm only, nor does he devote his whole book to accusations. Like every doctor, he is interested not only in the diagnosis, but in the treatment. There is an optimistic note given in the early part of the book when he points out that many youngsters are really not taken in by their mothers'

shams, but view them with amused and affectionate tolerance. As one youngster put it, "It is alright if it makes Mother happy," and these wise children are probably little affected. Furthermore, there is another phase mentioned by the writer; namely, that the period spent in the Army and Navy was really a benefit to many of them by parting them from their mothers' apron strings and really allowing them to develop and grow into a mature personality stature. He also concludes with some chapters "How can we help them?"; "What can Mom do about it"; and "Design for childhood." He has also a chapter "Are you a Mom?" with a list of 40 questions for a personal check-off list, which I think a lot of mothers are going to approach with a great deal of care. The final chapter, in which Dr. Strecker summarizes the situation and significance of it, is alone worth the price of the book.

MEDICAL RESEARCH, edited by *Austin Smith, M. D.*; authors: *Walter O. Alvarez, M. D., Professor of Medicine, University of Minnesota, Graduate Medical School, Division of Medicine, Mayo Clinic; Milton G. Bohrod, M. D., Pathologist and Director of Laboratories, Rochester General Hospital, Rochester, N. Y.; Eldon M. Boyd, M. D., Professor and Head of the Division of Pharmacology, Queens University Medical School; Herbert O. Calvery, Ph. D. (Deceased) Chief, Division of Pharmacology, Food and Drug Administration, Federal Security Agency; S. DeWitt Clough, Chairman of the Board of Abbott Laboratories; Morris Fishbein, M. D., Editor of the Journal of the American Medical Association and of Hygeia; H. Lou Gibson, Technical Editor, Medical Division, Eastman Kodak Co., Rochester, N. Y.; Torald Sollmann, M. D., Dean Emeritus of Western Reserve University School of Medicine; Austin Smith, M. D., Secretary, Council on Pharmacy and Chemistry, Director, Therapy and Research, American Medical Association.* 169 pages; 17 illustrations, including 10 subjects in color. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1946. Price \$5.

In a book of approximately 169 pages, the editor has brought out the opinions of various men who have been interested in medical research. The various authors of each section, of which there are eight, give their own views of the validity of medical research and its relation to the contributor's field of effort. Medicine is an art developed by experience. The lead in developing experience is research, whether clinical, philosophical, or technical. Its development and the resultant improvement in our techniques is not the result of one person's efforts, but of the broad combination of many. A man may be a leader in his field, but it is his staff that does the drudgery of research and who usually get no credit. This book offers a symposium of the ideas of various men. Their application is the result of the individual's approach to the general problem under consideration.

THE DIFFERENTIAL DIAGNOSIS OF JAUNDICE, by *Leon Schiff, Ph. D., M. D., Associate Professor of Medicine, Department of Internal Medicine, University of Cincinnati, Medical School; Director, Gastric Laboratory, Cincinnati General Hospital.* 313 pages; numerous illustrations. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1946. Price \$5.50.

The clinician who has watched the development of jaundice in an old patient and who has racked his brain to try to establish a diagnosis will appreciate this book. The author has covered the field thoroughly. The book is divided into seven parts, starting with a discussion of the characteristics and classifications of jaundice. Emphasis is well placed on the necessity of determining whether or not the case is one of "medical" or "surgical" jaundice, so that the physician may be guided correctly in making his decision in regard to therapy. The subject matter has been divided into parenchymal, neoplastic, calculous, and retention jaundice with many references from various authors. One complete section of the book is devoted to the technical aids in differential diagnosis, emphasizing the patient's history as the foundation for further work. The use of x-ray, laboratory procedures, and liver biopsy or peritoneoscopy is discussed in its relation to the study of different cases. The final chapter of the book is a résumé of the various laboratory procedures in detail, giving the methods of laboratory procedure. The author has given in about 300 pages a very complete coverage of his subject. The book is easy to read and will serve as a valuable refresher for the busy clinician.

CONTACT LENS TECHNIQUE, A Concise and Comprehensive Textbook for Practitioners, by *L. Lester Beacher, O. D., D. O. Sc., F. D. S. F., Consultant and Lecturer, Director of American Contact Lens Research Laboratories, formerly Instructor in Theoretic Optics Pennsylvania State College of Optometry (1927-29); formerly Chief of Staff, Bronx County Optometric Clinic Service (1929-31).* 4th edition, revised and enlarged. 296 pages; illustrated. L. Lester Beacher, Newark, N. J., publisher, 1946. Price \$5.

A useful book for the optometrist and also for the ophthalmologist. Beginning with the most elementary information it goes on to give a complete account of contact lens technique. The psychological effect of the lenses is well described.

The work brings out the necessity for knowing the subject well and the precise character of the task of fitting and using the contact lens. The illustrations are particularly good and are placed in sequence to show step-by-step performance of the technique. The bibliography, however, is limited to a list of articles previously published by the book's author.

LECTURES ON PREVENTIVE MEDICINE, by *Harvey Sutton, O. B. E. (Mil.), Lt. Col. A. A. M. C. reserve; M. D., D. P. H. (Melb.); B. Sc. (Oxon.); F. Roy. San. Inst.; F. R. A. C. P., Professor of Preventive Medicine, Director of School of Public Health and Tropical Medicine, University of Sydney.* 658 pages; numerous illustrations. Consolidated Press Ltd., Sydney, Australia, publishers, 1944.

This book presents a compilation of lectures delivered in the course of Public Health and Preventive Medicine at the University of Sydney.

It is rather a book on general hygiene than preventive medicine, and covers a diversity of subjects in great detail with much general information not ordinarily found in a text book. In fact one is surprised to find so much minutia in the text of lecture material.

The subject matter is divided into four grand parts but designated as chapters with an introduction and an appendix. The chapters were to bring together like or related material. The style of writing is good, clear, and understandable even by laymen. It is an excellent book for students for whom it is intended and for public reading.

THE CHEST, A Handbook of Roentgen Diagnosis, by *Leo G. Rigler, M. D., Professor and Chief, Department of Radiology, University of Minnesota.* 352 pages; numerous illustrations. The Year Book Publishers, Inc., Chicago, Ill., 1946. Price \$6.50.

Packed in a small handbook, the author has put a lot of information in condensed form. This book should be a most valuable ready-reference book for the physician who has his own x-ray or depends upon the services of a small hospital where pictures are taken by a technician.

The field of chest roentgenology is divided into a number of sections with a table of contents in the beginning of the book for ready reference. The subject matter is well indexed and the illustrations and serial plates give good examples to illustrate the author's text.

ULCER OF THE STOMACH, DUODENUM AND JEJUNUM, by *Ralph C. Brown, M. D., Professor of Medicine, University of Illinois College of Medicine; Attending Physician, Presbyterian Hospital, Chicago, Illinois. Edited by Henry A. Christian, A. M., M. D., LL. D., ScD. (Hon.), F. A. C. P., Hon. F. R. C. P. (Can.); Hersey Professor of the Theory and Practice of Physic, Emeritus, Harvard University; Clinical Professor of Medicine, Tufts College Medical School; Physician-in-Chief, Emeritus, Peter Bent Brigham Hospital; Visiting Physician, Beth Israel Hospital, Boston, Mass.* 56 pages; numerous illustrations. Oxford University Press, New York, N. Y., publishers, 1946. Price \$4.50.

This book is a reprint of the same chapters of the Oxford Loose-leaf Medicine. It gives all the old standard methods of diagnosis and treatment. It makes available the information previously printed in the regular loose-leaf sets. The reviewer does not find any reference to the more recent advances in this field such as gastroscopy or the use of amino acids, protein hydrolysates, or the parenteral methods of feeding. Several series of diagrams of ulcers and the progress in each case are presented in interesting forms. There is nothing in this book not already available to the possessors of the full loose-leaf text, according to the editor.

PREVENTIVE MEDICINE

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LONG-TERM OBSERVATION OF PLASMODIUM VIVAX MALARIA IN THE RETURNED SERVICEMAN¹

Part I

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With the cessation of hostilities and the rapid demobilization of many thousands of ex-servicemen who will undoubtedly suffer from malarial attacks that were originally service-acquired, it is believed that certain observations in regard to the clinical course and laboratory findings of both the acute relapse and the remission phase of benign tertian malaria as noted in returned servicemen will be of interest to the general medical profession.

The Tropical Disease Service of the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., has been engaged in the clinical testing of new antimalarial drugs, to compare their activity with that of quinacrine² and quinine. A unique opportunity was afforded for the study of the clinical features and any unusual sequelae of malaria because large numbers of patients were held under close observation on the wards for periods of time varying from 1 to 9 months. Any

¹ This is the first in the series of three parts in which this article will be published. The second and third parts will appear in succeeding issues of the BULLETIN.

² Wherever the word quinacrine appears in this article it refers to the drug commonly known as atabrine.

unusual manifestations noted were carefully evaluated as to their relation to the malaria or drug administered.

Following the completion of the observation period on the wards, selected cases were held in this area for a period of 1 year during which time they were readmitted for further study if any relapse occurred.

A casual perusal of the literature on the effects of malaria, will reveal a host of alleged sequelae and symptoms that are limited only by the imagination of the author and credulity of the reader. In the past, most of these alleged sequelae have been attributed to infection with *Plasmodium falciparum*, but there has been noted in recent literature a growing tendency to attribute any bizarre or unexplained symptom to the fact that the patient under study had or has malaria of the benign tertian type, due to a South Pacific strain of *Plasmodium vivax*. Our experience in trying to evaluate some of these alleged manifestations and sequelae of South Pacific acquired *P. vivax* malaria will, we hope, be of aid in any future study of the malaria problem.

OBSERVATIONS AT BETHESDA

The present report deals with the clinical manifestations recorded in approximately 1,500 attacks of malaria observed from September 1943 to November 1945 in Marine and naval personnel. *P. vivax* was the cause in all cases, and although a diagnosis of previous infection with *P. falciparum* was recorded in the medical histories in some, there was observed not a single case of this type even in servicemen only returned from an endemic malarial zone within 2 weeks. This lack of persistence of *P. falciparum* is attributed to the fact that in all cases, the patients had been on more or less regular quinacrine suppression for varied periods of time. This has been the experience of others (1) and experimentally it has been shown by inoculation of volunteers with *P. falciparum* (2) that the continued use of suppressive quinacrine for 1 month following inoculation completely prevents any subsequent clinical manifestations. In this respect quinacrine might be considered a true causal prophylactic were it not for the fact that in similar experiments, transient parasitemia has been noted and the infection transmitted to susceptible individuals by subinoculation of blood (2). For all practical purposes, however, quinacrine can be considered a "cure" for *P. falciparum* malaria, inasmuch as routine treatment of the acute attack followed by daily suppression for 1 month will prevent any future relapses.

The patients in this study comprise two large groups. Approximately one-third of them were men recently returned from overseas

duty in the Pacific and transported by air from the point of arrival on the Pacific coast to this activity. The other two-thirds were men who had been back from overseas from 2 to 18 months and had not been under quinacrine suppressive therapy for this length of time.

HISTORY PRIOR TO OBSERVED RELAPSE.

(a) *Quinacrine Suppression*.—The vast majority of patients gave a history of regular suppressive quinacrine for varied periods of time. In some, the dosage was one which was later proved to be inadequate for preventing relapses in the field (0.4 gram weekly), but there were many who claimed regular and adequate suppression (0.1 gram daily), yet who developed clinical malaria during the period of suppression. It is to be doubted that the men who claimed relapses while on supposedly adequate suppression really ingested the declared amounts of quinacrine. The heat of battle, precious liberty, personal beliefs or other reasons were sufficient to cause many to omit the daily quinacrine tablet occasionally. It must not be forgotten, however, that even under what is considered adequate suppressive therapy under supervised conditions, well authenticated cases of "break-through" malaria have been reported (3). Poor absorption, excess degradation activity, inadequate preliminary saturation of body tissue before suppressive regime, or other unknown factors may all be responsible for "break-through" malaria. One case in which parasitemia and mild clinical symptoms persisted even though plasma quinacrine levels were well above the "suppression level" was observed.

(b) *Number of previous attacks*.—In trying to elicit the number of previous attacks of malaria, it was soon found that such a history was unreliable if the number of attacks exceeded 10. Some patients had bizarre ideas of what constitutes an attack and the number of previous attacks were variously reported at from 2 per week to 36 per year. The most common error found in trying to calculate this factor was that each chill was interpreted as an attack. Another common finding was that many of the men treated themselves without benefit of medical opinion or advice when they "thought" they had malaria. In the vast majority of cases, self-treatment was inadequate and merely suppressed the acute activity for a few days and when renewed activity took place, this was classified as a new attack in the mind of the patient and so reported.

PERIOD OF EXPOSURE TO OBSERVED PRIMARY ATTACK

Considering only those cases that were on fairly adequate suppressive therapy while in an endemic area, the cases included in this report showed a period of 12 to 34 months' travel in endemic areas without clinical malaria.

DIAGNOSIS OF MALARIA

In the majority of chronic relapsing cases, the patient makes his own diagnosis. It was found that in most of the cases, the patient was right when he insisted that he "felt like malaria" even though the thick smears were reported negative during the first day of admission. Each man seems to have a particular symptom complex that he experiences prior to the typical paroxysm. The basic framework of this symptom complex common to most is headache, general malaise, low back or lumbar pain, and vague gastro-intestinal symptoms. Superimposed on these common symptoms are those peculiar to the individual such as "freezing of a big toe," "twitching ears," "can't talk," "increased salivation," or numerous other subjective symptoms which the patient cannot elucidate other than insist that "I know." Notwithstanding respect for the patient's self-diagnosis, there were found exceptions numerous enough to require insistence on withholding anti-malarial therapy until a positive smear was obtained and the clinical picture agreed with a diagnosis of malaria. In the presence of malarial fever, with or without an enlarged spleen, there was no failure to find parasites in the peripheral blood within 72 hours when thick smears were examined every 8 hours by competent technicians. The importance of competent technicians for examination of thick smears cannot be overemphasized. Sternal or splenic punctures for the diagnosis of malaria (4) never had to be done. In view of the well-known relapse tendency of *P. vivax* and the frequent occurrence of transient asymptomatic parasitemia, which appeared in about 5 percent of the cases, reaching in 1 case, 24 parasites per field, little importance is attached to the demonstration of parasites by bone marrow or splenic puncture. Transient asymptomatic parasitemia has been noted by others studying similar types of cases (5).

It is not felt that a delay of a few days in making a diagnosis of *P. vivax* malaria makes any essential difference in the final outcome but it is essential to rule out more serious diseases in which early therapy may be lifesaving, such as pneumonia, meningitis, septicemia, and other diseases that have been sent to the malarial ward as malaria. Occasionally a malaria case will be sent to the infectious disease ward, but mistakes have been found to be much more numerous in calling a serious disease malaria because of a patient's history and self-diagnosis. It is the authors' clinical impression that malaria patients soon develop an individual "chill pattern" of reaction that is set off either by malaria or an acute infectious disease. Curiously enough, infectious mononucleosis was frequently the correct diagnosis in non-malarial patients admitted as malaria, and in some cases a transient parasitemia was demonstrated.

As observed in this series, the temperature curve was characteristic only in that it was of "spiking" character. Even in the same patient who was observed and treated for 3 or more relapses, the temperature curve might show on one relapse a daily rise of temperature, on another a "spike" every other day, and on the third relapse a double peak on the same day. However, with the exception of only a few cases, the temperature curve was not obtained for more than two paroxysms, because the diagnosis had been made by this time and treatment started.

In addition to the clinical picture and positive smear, certain laboratory findings, to be discussed later, are consistent with the diagnosis of a malarial attack. These are the presence of a leukopenia with increase in mononuclear cells, increased erythrocyte sedimentation rate, and an otherwise unexplained positive Kahn test.

CHARACTERISTICS OF "DELAYED" PRIMARY ATTACKS.

In most cases, the first clinical manifestations occurred 2 to 10 weeks following the discontinuance of suppressive quinacrine therapy, but occasionally clinical malaria first developed many months later. A brief summary of 4 such cases follows. In one, a Marine officer who had been in the original landing on Guadalcanal in August 1942, and who was exposed to malaria for approximately 3 months before evacuation to this country, no symptoms were noted until his first attack which occurred approximately 18 months after evacuation. The second case was that of a civilian engineer consultant with the Army who spent about 3 months in New Guinea and who had no symptom of malaria until 1 year after his return to the United States. The third case was that of a young aviator who was shot down in the Philippine area, and lived for 1 month in the hills with a group of guerrillas. During this period he took some quinacrine and quinine, but the exact amount is not known. Following his rescue, he was evacuated to a nonmalarious area and remained free of any manifestations until his admission here with a delayed primary attack of benign tertian malaria, 12 months after his original exposure. The fourth case was that of a sailor who was present during the early days of the battle for Guadalcanal, and who had continuous duty in malarious areas for 30 months. When observed here in his primary attack, he had been off suppressive quinacrine therapy for 14 months. None of these four men gave a history of exposure in any hyper-endemic malarial area of the United States, but since *P. vivax* malaria has been reported (6) in the Washington, D. C., area, a locally acquired infection cannot be ruled out with certainty. However, it is believed these cases represent true delayed primary attacks.

In the authors' experience, the delayed primary attack of malaria is insidious in onset, featuring irregular temperature with chilly sensations rather than chills, a feeling of malaise, anorexia, headache, and progressive weakness. Early in the course, parasitemia may be difficult to demonstrate. Many of these cases are treated as pneumonia, catarrhal fever, or other conditions for several weeks before the true nature of the disease becomes apparent. By this time there is usually obvious splenic enlargement, icterus, and anemia. It was found that the best method of early diagnosis was by repeated thick smear examinations by competent technicians every 8 hours throughout the day. Parasitemia is commonly of low density and reveals itself during the first few days. The early diagnosis of malaria in these cases is often made more difficult because of the empirical use of the sulfonamides in large doses by the attending physician. Such therapy masks malaria and is to be condemned.

SPECIAL CLINICAL FEATURES

The typical malarial paroxysm is well known and needs no further description. Early in this study, however, it became apparent that the symptoms during the intervals between acute relapses differed markedly between the two groups of patients studied. Men in the group which had been in this country for several months showed, in general, no unusual behavior and presented very little in the way of psychosomatic signs and symptoms following adequate treatment of the acute attack. The exceptions in this general statement will be discussed more fully later, but as a whole, this group was ready for return to duty soon after treatment and few offered any persisting complaints.

The group of patients which had only recently been evacuated from overseas and flown to this activity presented a different behavior pattern. They were, in general, very tense, hyperactive, showed tremors, perspiring palms, anorexia, anxiety, battle dreams, and startle reactions. No frank psychoses were observed except minor delirious episodes during the peak fever period which subsided following the patient's recovery from the acute attack. Frank chills were absent in 10 percent of these patients. It was not possible to correlate these psychosomatic manifestations with the degree of malarial activity. Patients observed in the intervals between acute relapses exhibited just as severe anxiety symptoms as those suffering from acute malaria. In addition, these symptoms disappeared completely in most cases following psychotherapy or with the mere passage of time, and many of them who returned with relapsing malaria in later months showed a normal behavior pattern. The time has come for a more critical evaluation of the large amount of literature that has

accumulated referring to the causal relation of malaria to the development of neuropsychiatric symptoms (7), and a more detailed study of a group presenting neuropsychiatric symptoms will be analyzed later.

The authors are aware of the fact that the majority of alleged post-malarial manifestations have been attributed to infection with *P. falciparum*, but the cases in which previous malignant tertian infections were recorded in health records did not appear to differ from those in which no *P. falciparum* was noted and the future clinical course of the patients was the same.

Malarial cachexia was conspicuous by its absence. No case of this alleged complication was seen that could be attributed to malaria alone. Moderate to severe degrees of undernutrition were occasionally observed, but adequate diet and rehabilitation, accentuating the psychiatric care, resulted in prompt improvement of all cases. It was common to note a loss of weight of several pounds during an acute attack of malaria, but after treatment was given and the appetite returned this loss was quickly regained.

The *chronically enlarged spleen* so frequently reported in the literature as a characteristic of chronic malaria was not observed in this series, even in those patients who were still suffering repeated relapses after 2 or more years following the last probable infection. However, a palpable spleen was a common finding during an acute attack and in a series of 121 cases where careful attention was paid to examination for an enlarged spleen, 47 percent showed this sign. It is frequently difficult to determine the presence of a large spleen on physical examination because tenderness and spasm over the upper half of the abdomen is present in the majority of cases. Following adequate anti-malarial therapy, when the acute tenderness and spasm of the upper abdomen had disappeared the spleen was not palpable in any case. About 10 percent of the patients claimed persistence of some tenderness over the left upper quadrant or along the left costal margin. The exact mechanism behind this complaint is not understood. Whether a perisplenitis, a low-grade, persisting, splenic-capsule inflammation, or reflex phenomena from an enlarged yet not palpable spleen, are contributory, remains to be determined. On several occasions, this type of subcostal pain resulted in the erroneous diagnosis of pleurisy. Enlargement of the liver has been rarely noted in the absence of evidence of anemia during an acute attack. This finding is usually associated with an increased icterus index.

Herpes simplex has been frequently described as an accompaniment of the acute attack of malaria (1) (8). In 368 cases of the acute variety, herpes simplex was found in 19.5 percent. Herpetic lesions were frequently extensive involving both lips at times and one or both ears. It was not constant in appearance in the same individual, being

absent during one attack and present during another attack, but in the majority of cases observed where it recurred in the same individual, it usually assumed a similar pattern with each attack. In the more severe and extensive involvement, we have found x-ray radiation therapy to be the best treatment.

Urticaria has been previously described by others (9) and 6 cases of recurrent extensive urticaria associated with the acute attack were observed during this study. Curiously enough response to the usual remedies of adrenalin, calcium gluconate intravenously, ephedrine, etc., was poor, and invariably the urticaria would subside with anti-malarial drug therapy.

LABORATORY OBSERVATIONS

Leukopenia is fairly common during the acute attack of malaria and, as shown by table 1, 15.4 percent of cases showed a leukocyte count of less than 5,000, and in the majority an increase in the mononuclear series was noted on the differential count. The lowest recorded leukocyte count was 2,750, and the highest was 14,750. Thus, during an acute febrile episode occurring in a patient with relapsing vivax malaria where the diagnosis is not apparent, a normal or low leukocyte count with an increase in the mononuclear series favors the diagnosis of malaria. As can be seen from the table, following adequate treatment of the acute attack, the majority of patients rapidly develop a normal or even elevated leukocyte count. In several cases where malaria was complicated by an acute infectious disease such as follicular tonsillitis the leukocyte count was definitely elevated with a shift in the differential series toward the polymorphonuclear type of cell.

TABLE 1.—Percent distribution of total leukocyte counts in malaria patients during the acute attack and in the remission phase

Range of leukocyte count	Acute	Remission
	<i>Percent</i>	<i>Percent</i>
Less than 4,000.....	3.2	0
4,000-5,000.....	12.2	3.4
5,000-6,000.....	22.8	7.5
6,000-8,000.....	32.4	17.1
8,000-10,000.....	21.2	33.6
More than 10,000.....	8.2	38.4
Total percent.....	100	100
Total number of cases.....	377	146

Contrary to the statement in a popular textbook of clinical pathology (10), it was found that the erythrocyte sedimentation rate is increased during the acute attack in the majority of cases. Reference to table 2 shows that an increased erythrocyte sedimentation rate was noted in 68.9 percent of cases during the acute attack as compared with 16.3 percent of cases in the remission phase. These results are in agreement with others studying similar types of cases (11).

TABLE 2.—Percent distribution of erythrocyte sedimentation rate (Cutler method) in malaria patients during the acute attack and in the remission phase

Rate (Normal=10 mm. in 1 hour)	Acute	Remission
	<i>Percent</i>	<i>Percent</i>
Less than 5.....	8.1	58.9
6-10.....	23.0	24.8
11-20.....	51.6	14.7
20 plus.....	17.3	1.6
Total number of cases.....	335	129

While not striking, there has been noted in this series of cases, the development of a mild anemia during the acute attack. Reference to tables 3 and 4 indicates there is apparently rapid recovery of the erythrocytes and hemoglobin during the remission phase. The most severe anemias were found in patients suffering delayed primary attacks, which, in most cases, continued undiagnosed for several weeks prior to admission here. Except for this latter group, there was rapid recovery in most cases with routine diet without the necessity of special supplements such as iron, liver, and vitamin preparations.

TABLE 3.—Percent distribution of hemoglobin in malaria patients during the acute attack and in the remission phase

Percent hemoglobin (14.5 grams=100%)	Acute	Remission
	<i>Percent</i>	<i>Percent</i>
Less than 70.....	5.1	0.0
71-80.....	14.4	.8
81-90.....	37.5	15.8
91-100.....	31.1	57.2
100 plus.....	11.9	26.2
Total percent.....	100	100
Total number of cases.....	373	145

TABLE 4.—Percent distribution of erythrocyte count in malaria patients during the acute attack and in the remission phase

Range (in millions)	Acute	Remission
	<i>Percent</i>	<i>Percent</i>
Less than 3.0.....	1.8	0
3.1-4.0.....	32.9	0
4.1-4.5.....	31.5	11.8
4.6-5.0.....	26.6	38.2
More than 5.0.....	7.2	50
Total percent.....	100	100
Total number of cases.....	222	34

ICTERUS INDEX AND CEPHALIN FLOCCULATION TESTS

An increase in the icterus index was commonly noted during the acute attack. Seventy cases were tested within 48 hours after admission, and only 5 of them showed values of 5 or below. Forty-six cases were reported as 6-14 and 19 cases showed values of over 15. A simultaneous cephalin flocculation test was performed in 48 cases and the results as shown in table 5 were obtained.

TABLE 5.—*Cephalin flocculation values found during first 48 hours of acute attack*

Value	Number of cases	
	24 hours	48 hours
0	13	12
1+	14	8
2+	15	16
3+	5	11
4+	1	1

The complement fixation reaction using *Plasmodium gallinaceum* as an antigen was studied in a series of patients. Fifty cases were observed in a proved relapse treated adequately with routine quina-crine, and followed until the next relapse developed. Twice a week, blood smears were examined for parasites and simultaneous complement fixation tests were done using the chick malaria antigen of *P. gallinaceum*. The time interval between relapses varied from 21 to 120 days. No relationship between the degree of positivity of the complement fixation test and any impending relapse could be established. The test was frequently negative with or without parasitemia and the strength of the reaction varied for no apparent reason. This test is not considered to be of any aid in the diagnosis of the acute attack; it may have some value, if positive, in showing that the patient had or still has malaria, but that appears to be all that can be gained from the test at the present time.

SEROLOGICAL TESTS FOR SYPHILIS IN MALARIA³

The serological procedures used as aids in the diagnosis of syphilis are generally surprisingly accurate and specific. There are, however, certain conditions including malaria which may give rise to positive or doubtful reactions in the absence of syphilis.

With the development of new techniques, new tests, and more sensitive antigens, the accuracy of the serologic diagnosis of syphilis has doubtless been increased, but nonspecific positive reactions as well have

³ This section was prepared by G. M. Saunders. It was presented to the Section on Biology, Parasitology, and Tropical Medicine of the First Pan-American Medical-Social Congress, Havana, Cuba, 3-8 Dec. 1946.

probably become more numerous. Recent observations have shown conclusively that malaria alone may cause positive serological tests although 10 years ago there was still some doubt on this point (12).

In a recent study (13) of 100 nonsyphilitic patients suffering attacks of vivax malaria, the standard Kahn flocculation tests on blood samples taken within 5 days of the onset of the attacks were positive in 33 cases and doubtful in 11 which totals 44 percent with abnormal Kahn reactions. In the great majority of these, tests became negative within 4 weeks, and in no case did positive tests persist more than 11 weeks.

In another group of 100 patients with acute malaria from whom sera were taken for testing within 48 hours of admission to a hospital, 12 percent gave positive reactions with either the Kahn or Wassermann tests, and an additional 10 percent showed doubtful reactions, or a total of 22 percent (14).

Rosenberg (15) reported on 8,000 serological tests on sera from malaria patients without previous evidence of syphilis. The various flocculation tests and the Kolmer complement fixation reaction were performed repeatedly on samples of blood drawn at increasing intervals after the onset of acute malaria. The Kahn tests were positive or doubtful in about 50 percent of the cases, the most strongly positive reactions occurring 7 to 10 days after the initial chill and persisting for about 4 to 6 weeks.

Kitchen et al. (16) studied the Kahn and Wassermann reactions in a group of 25 persons before, during, and after attacks of mosquito-induced malaria. Blood samples for testing were drawn twice a week during the incubation periods, during the acute attacks, which persisted from 12 to 72 days, and subsequently until the sera gave negative reactions. Positive tests were obtained at some time in every case. Only 2 failed to show positive Kahn tests and another 2 failed to give positive Wassermann reactions. Seventy-two percent of the positive reactions first appeared during the third and fourth week following inoculation and in 68 percent the first positive reactions appeared during the first 2 weeks of clinical activity.

A similar study was carried out by Burney et al. (17) who inoculated 11 nonsyphilitic dementia praecox patients with vivax malaria. Blood was drawn for serological tests once a week during the incubation period, every 4 days during the stage of clinical activity, and once a week after the termination of attacks by quinine until the serological tests became negative. Tests were performed by several laboratories using standard techniques for the Eagle, Kahn, Kline, Kolmer, and Hinton tests. Attacks were terminated after 10 paroxysms which would indicate about 3 weeks of clinical activity. All patients had at least 1 positive reaction to the Kahn or Kline diagnostic tests during or after the malaria attacks. The number of

positive reactions increased during the second and third weeks of clinical activity, but practically all had become negative within 3 weeks after the termination of the attacks. The percent of positive Kahn standard tests increased to a maximum of 88 during the third week after parasites first appeared, but all tests had reverted to negative by the seventh week. A total of 1,069 tests were made during the period of observation of which 269, or 25 percent were positive. Forty-one percent of 241 Kahn tests, 29 percent of 258 Kline tests, and 32 percent of 239 Kolmer complement-fixation reactions were positive, but none of 100 Hinton tests was positive.

A new antigen, cardiolipin, promises to be highly sensitive and specific in the diagnosis of syphilis. In a group of nonsyphilitic malaria patients studied by Rein and Bossade (19) all gave positive serological tests with the usual standard procedures, but none was positive with the cardiolipin antigen. However, positive cardiolipin as well as other tests have recently been obtained in this hospital in a few malaria patients who are believed not to have syphilis. Therefore, some nonspecific positive tests with the cardiolipin antigen may be expected in malaria, although the proportion will probably be small.

OBSERVATIONS IN THE PRESENT SERIES OF PATIENTS

During the past year serological tests were recorded at least once on each malaria patient admitted to the Tropical Disease Service of this hospital. In the majority of cases, the patients were admitted with acute malaria in the first few days of the attack, but a number were first seen during remissions. A few were experiencing their first attack, but most had repeated attacks numbering from 2 to 25 or more. In all cases a diagnosis of vivax malaria was made from blood examinations here or elsewhere, and all but a few had been infected in the Southwest Pacific area. Many patients were held under observation for several months in an attempt to evaluate the effect of chemotherapy, and this permitted repeated observations in the same patients, in subsequent attacks of malaria.

Blood was drawn for serological tests as a routine procedure, usually within 1 or 2 days after admission. In case of positive or doubtful results, samples were tested subsequently in most instances, although there was no systematic attempt to check serological tests at definite intervals. Several patients whose blood gave positive tests were lost sight of before more specimens could be taken.

All tests were performed in the serological laboratories of the U. S. Naval Medical School. Presumptive Kahn tests were used to screen the samples after which all sera reacting with the presumptive antigen were submitted to the standard test. In case of positive or doubtful results with the standard tests, the Kolmer complement fixation and the Mazzini tests were performed in most instances. Each lot of the

Kahn antigen, manufactured and standardized at the Naval Medical School, was also checked in Dr. Kahn's laboratory.

RESULTS OF SEROLOGICAL TESTS

Observations are recorded on all patients with malaria in table 6. Some were observed during and after more than one acute attack, and others were observed only once. In most cases where the blood samples for serological testing were taken within a few days of the onset of symptoms, the diagnosis of malaria was confirmed by examination of blood smears in the laboratories of the Naval Medical School, although a few had been confirmed by laboratories elsewhere. In cases in which the acute attack had ended before serological tests were made, the diagnosis of malaria had been confirmed elsewhere, as a rule. But in a number of instances these patients were subsequently seen here during an acute attack. The length of time between the onset of symptoms and the time of testing was obtained by careful questioning of the patients and is felt to be reasonably accurate.

TABLE 6.—*Results of serological tests on 508 samples in all malaria patients*

Time after onset of last acute attack to negative or first positive test	Result				Total cases
	Negative		Positive or doubtful ¹		
	Number	Percent	Number	Percent	
0-6 days.....	270	89.7	31	10.3	301
7-13 days.....	42	79.2	11	20.8	53
14-20 days.....	19	95	1	5	20
21-27 days.....	12	100	0	0	12
28-34 days.....	9	100	0	0	9
35-41 days.....	12	100	0	0	12
6-8 weeks.....	36	100	0	0	36
2 months.....	31	100	0	0	31
3 months.....	12	100	0	0	12
More than 4 months.....	22	100	0	0	22
Total.....	465	91.5	43	8.5	508

¹ First appearance of positive or doubtful tests; subsequent positive tests in the same patients not included.

Table 6 shows that positive or doubtful serological tests were found in 43 of 411 patients tested 508 times, or in 10.4 percent and 8.5 percent, respectively. The proportion of cases with positive serological tests increased from about 10 percent during the first week after the onset of acute malaria to about 21 percent during the second week and then dropped to 5 percent during the third week. In no case did the first abnormal serological test develop after the third week. Tests were repeated in most positive reactors after a lapse of time but the results were not included in table 6, because to do so would unduly weight the number of positive reactors. If positive results found in the weeks after their first appearance were included, the percentage of positive reactors in the second and third weeks after the onset of acute attacks

would be greater than shown in table 6. For the second week the percentage of positive reactors would be 29 instead of 20.9, and for the third week, 24 instead of 5 percent, but values for subsequent weeks would not be affected. The total number of patients giving positive tests at some time remains the same, 43 out of 411 or 10.4 percent. In about two-thirds, the tests had reverted to negative within 4 weeks although in several cases follow-up tests were not done.

A comparison of results with the three tests used reveals that the Kahn test gave the largest number of positive or doubtful reactions, and that the Kolmer complement fixation reaction gave the smallest number (table 7). In many instances when the Kahn test was positive or doubtful, the Mazzini and Kolmer tests were negative. In a few cases when the Kahn tests were positive or doubtful the Kolmer reaction was recorded as anticomplementary.

TABLE 7.—Comparison of tests in 43 serologically positive patients

Procedure	Result			Total
	Positive	Doubtful	Negative	
Kahn.....	25	16	2	43
Kolmer.....	15	0	21	36
Mazzini.....	14	7	11	32

The degree of positivity varied considerably, but only a few reactions were very strongly positive. One sample gave 120 Kahn units, and another as much as 160 Kolmer units. Apparently the strength of the tests and also the percentage of sera giving positive reactions increased with the duration of clinical activity of malaria. In the great majority of patients treatment interrupted the acute attacks within a few day of onset. However, in patients experiencing their first attack of malaria, activity had continued for more than a week in several before medical advice was sought. In the present series there were 18 patients who had serological tests recorded during the first attacks. Fifty percent of them gave positive or doubtful Kahn tests, but 75 percent of those tested during the second week of activity gave positive tests (table 8).

TABLE 8.—Results of Kahn tests in primary malaria attacks

Days after onset	Result		Total
	Negative	Positive or doubtful	
0-6.....	7	3	10
7-13.....	2	6	8
Total.....	9	9	18

Among the positive reactors in this series were 12 patients who were observed during and after 2 or more attacks of malaria. In some the serological tests were positive during earlier attacks and not during the following attacks, while in others, the reverse was true. Positive tests were found in more than one attack in only one patient in whom doubtful Kahn reactions were recorded on the tenth day of his first attack and on the fourth day of his second attack. There seems to be no consistent reappearance of abnormal serological reactions in the same individuals with recurring attacks.

DISCUSSION

There can be little doubt that malaria alone may cause positive serological reactions in a large proportion of cases with the majority of the tests in common use today as aids in the diagnosis of syphilis. Studies on patients in whom clinical activity of malaria was allowed to continue for several weeks reveal that in all cases positive serological tests are found at some time, with use of one or more of the standard procedures. The percentage of positive reactors increases during the second and third week after the onset of clinical malaria, but tests revert to negative in most cases within 4 weeks, and in all cases within 10 weeks after onset. Apparently, however, when clinical activity has persisted only a few days, a much smaller percentage of persons will develop positive reactions, although the first appearance of positive tests is commonly delayed until the second week after onset of clinical malaria. The duration of clinical activity appears to have little effect upon the persistence of positive reactions, which are seldom encountered more than a month following the onset of the acute attack. Strongly positive reactions are uncommon as a result of malaria alone and there is seldom complete agreement when several tests are used. Considering all factors "false" positive serological tests in persons with malaria should not cause confusion or be a source of error in diagnosis. In a more or less random sample of sera in malaria patients when blood is drawn during clinical activity and between attacks as was done in the present study, about 90 percent of persons may be expected to give completely negative tests with the usual routine procedures. In possibly 20 or 30 percent of cases, one or more tests may give positive reactions within 2 or 3 weeks after the onset of clinical malaria, but positive tests are almost never found later than 4 to 6 weeks after the onset.

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OBSERVATIONS ON THE DISPERSAL OF DDT FROM AIRCRAFT FOR THE CONTROL OF MOSQUITOES ¹

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This report is based on field tests made on Guadalcanal in November 1944 and on Guam in August 1945, in which DDT was applied from aircraft for the control of mosquitoes. The effect on natural populations of adult mosquitoes and mosquito larvae was studied and evaluated in connection with the dosage used, the cover of vegetation, and the size and number of spray droplets recovered per unit of area.

Navy torpedo planes (TBM and TBF) were used in tests I, II, and IV and an Army transport C-47 was used in test III. The spray equipment has been described in detail elsewhere (1). The Husman-Fallander unit employed on the torpedo planes may be described briefly as consisting of a 270-gallon auxiliary fuel tank, four standard electrically driven fuel pumps, each with 400 gallons per hour capacity, and two spray elements, one mounted near the end of each wing. A spray element consisted of an 8-foot length of 1-inch metal tubing having nineteen 50-gage holes spaced about 4 inches apart, and a baffle bar secured to the tubing and mounted $\frac{1}{4}$ inch in front of the holes. The C-47 spray equipment consisted of a Venturi-type dispenser mounted under the fuselage, to which the spray solution was conducted by gravity through a 2-inch pipe leading from two 335-gallon tanks which were installed in the cabin.

The original work of Lindquist et al. (3) (4) on the control of adult mosquitoes by DDT dispersed from aircraft was followed in determining the dosage to be used.

TEST I

This test was conducted on Guadalcanal against adult mosquitoes. The test plot had an area of approximately 400 acres and measured 5,700 by 3,000 feet. It was mostly in dense forest with trees ranging in height from 20 to 150 feet.

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² Deceased 11 April 1945.

The cover of vegetation comprising both undergrowth and forest trees was estimated to be about 90 percent complete in the part which was sampled for mosquitoes (fig. 1). The terrain was low and swampy for the most part but was bordered on three sides by radiating ridges which were 100 to 150 feet high. One side was open to the sea.



—Official U. S. Navy Photo.

FIGURE 1.—Forest cover in test area, tests I and II.

A torpedo plane equipped as already described discharged the spray at an altitude of 100 to 200 feet traveling at a speed of 132 miles per hour. The flight lines were parallel and 150 feet apart. In maintaining this flight pattern the pilot was guided by aerology balloons which were anchored at tree-top height. The flight was made at about 1 hour after sunrise. The sky was overcast and there was a cross wind of 50 to 150 feet per minute. Flight lines were at right angles to the line of mosquito counting stations. The spray solution was discharged from the airplane at the rate of 80 quarts per minute. The solution contained 10 percent DDT, 5 percent cyclohexanone, and 85 percent equal parts of Diesel oil and aircraft-engine oil. On the basis of these figures the dosage was calculated to be 2 quarts of the solution per acre or 0.4 of a pound of DDT per acre.

The biological data and other pertinent information are presented in table 1. A natural population of adult mosquitoes composed of 3 species, *Aedes carmentis* Edw., *Aedes imprimens* Wald, and *Aedes funereus ornatus* Theo, was observed systematically before and after the test in order to evaluate the effectiveness of the treatment. These mosquitoes bite actively in the daytime so that it was possible to estimate the density of the population by observing their lighting rates. The lighting rate was determined by 2 men who counted the maximum number of mosquitoes alighting on their clothing over a 2-minute period at each of 15 stations. The stations were established along a line about 2,000 feet long which extended across the area to be treated. Each station was assigned a number and marked by a conspicuous flag. Counts were made in the early afternoon of each day for 13 days before the test. The records thus obtained demonstrated that the mosquito population remained relatively stable from day to day. The average daily total count for the period was 1,070 with a range of 644 to 1,452. The total mosquito count for the day before treatment was 1,133. Five hours after the spraying was completed the total count was 49, a reduction of 96 percent. The counts remained at this low level for 7 days when observations were discontinued.

TABLE 1.—Adult mosquito test I

Station	Mosquito counts									Droplet count per square inch	Percent cover of vegetation
	Before treatment			After treatment							
	Nov. 9-21		1 day before	5 hours	1 days						
	Average	Range			1	2	3	5	7		
1	8	2- 14	8	0	0	0	0	0	0	143	75
2	36	7- 71	23	0	0	0	0	1	1	67	90
3	57	15- 89	57	0	0	0	0	0	1	96	95
4	67	35- 99	60	1	0	0	1	0	0	62	95
5	79	42-108	88	1	0	0	0	2	4	43	95
6	72	40- 99	92	4	0	1	1	1	0	15	95
7	63	21-102	86	3	0	0	0	3	2	51	75
8	63	24- 91	72	7	0	0	0	4	1	29	95
9	75	33-100	81	4	1	0	0	3	1	41	95
10	82	32-150	85	8	0	0	2	1	0	29	95
11	76	46-140	93	6	2	0	1	5	0	19	85
12	101	73-129	111	9	0	0	2	2	2	19	90
13	95	72-132	82	4	0	1	2	2	4	13	95
14	93	50-117	89	2	0	0	2	4	2	41	95
15	101	72-159	106	0	0	0	2	7	2	68	80
All stations	1,070	644-1,452	1,133	49	3	2	13	35	20	Average 49	Average 90

Carbon-coated slides placed at the mosquito-counting stations during the test showed an average of 49 droplets per square inch. More detailed information on the technique of preparing the slides and the size of the droplets in the spray is given under test II.

TEST II

Test II was conducted in the same area as test I but different mosquito-counting stations were used and the effect on *Anopheles farauti* Lav. and *Anopheles lungae* B. and S. as well as *A. carmentis* was observed. More detailed information on the size of the spray droplets and the relative number of droplets penetrating the forest cover was obtained. The same airplane, spray equipment, and spray mixture were used as in test I. The rate of application was calculated to be 2 quarts of the spray solution or 0.4 of a pound of DDT per acre. The flight was

started about 1 hour after sunrise and completed in about 50 minutes. The flight pattern and altitude were the same as for test I. There was a slight cross wind the velocity of which varied in the open between 190 and 250 feet per minute.

Twenty carbon-coated slides were exposed in the open in addition to those at each of the mosquito-counting stations in the forested area in order to provide information on the droplet-size composition of the spray and the relative number of droplets penetrating the forest cover.



—Official U. S. Navy Photo.

FIGURE 2.—Daytime resting places of *Anopheles lungae* and *Anopheles farauti*. Station 3 of test II.

The slides were prepared and examined according to the technique devised by Wilson. Ordinary microscope slides are smoked by passing them through a Diesel oil or kerosene flame until the coating is heavy, but not completely opaque. The film should have a brown color when examined under the microscope by transmitted light. Oil droplets do not yield a satisfactory pattern on films lacking this color. The sharply defined circle immediately surrounding the dense center of the pattern is the part which is measured. Its diameter approximates the diameter of the original drop in the range 10 to 500 microns. Patterns of smaller droplets can be readily recognized but not very accurately measured. When properly used, this is a satisfactory field technique which yields valuable information on the size and distribution of droplets from oil sprays.

The density of the anopheline population was estimated by making counts at 10 selected locations along a line 900 feet in length which extended across a portion of the test area. Counts were made daily for 3 days before the test and 6 hours, 1, 3, 5, 8, 15, and 22 days after the test.

A. farauti and *A. lungae* rest on the buttressed trunks of large forest trees, usually from ground level up to 3 or 4 feet (fig. 2). They can be counted readily in these situations in the daytime without being disturbed. *A. carmentis* was found biting actively in the same area so the population density of this species was also determined at each of the 10 stations by observing their lighting rates as in test I. The mosquito counts, spray-droplet counts for each station, and the estimated percent of cover of vegetation are presented in table 2.

A routine check of all the stations 6 hours after treatment gave total counts of 260 anophelines and 1 *A. carmentis*. The counts for the previous day had been 498 and 114 respectively. On this basis the anopheline mosquitoes showed a reduction of 48 percent and the culicines 99 percent in 6 hours. It was noted that the surviving anophelines were much more easily disturbed than during the previous surveys, suggesting that these remaining mosquitoes were also affected by DDT at the time of the 6-hour count. Their behavior was quite typical of that exhibited by laboratory specimens so affected. This tends to be substantiated by the counts of the following day which gave a total of 9 anophelines, a reduction of 98 percent over the pretreatment count. Some of the 9 specimens were gravid females, indicating that they were not newly emerged specimens but had in all probability survived the treatment as adults. The more rapid disappearance of the culicine mosquitoes does not necessarily indicate greater susceptibility. Since biting activity was used as the criterion in the case of these mosquitoes, it may indicate that biting ceases soon after the irritant effect of the DDT is felt. Laboratory observations tend to substantiate this.

Continued observations of the mosquito population in the treated area showed no significant increase during the first week. At the end of the second week a moderate increase in both the anophelines and *A. carmentis* was observed and after 3 weeks both groups were again relatively abundant though the anophelines had not yet regained their former density (table 2). As scarcely enough time had elapsed for the anophelines to pass through two generations the record is consistent with what may be considered a normal increase under favorable breeding conditions. There were no large breeding places immediately outside the treated area. *A. carmentis* was more abundant 3 weeks after the spraying than it had been before the test. This species deposits its eggs on the ground in low spots where water collects after heavy rains. An accumulation of eggs was probably already present before the spraying and they hatched later when the breeding places were flooded.

Examination of the smoked slides showed that the average number of droplets per square inch reaching the ground at the mosquito counting stations was 160 with a range of 20 to 540 (table 2). The average number of droplets per square inch in the open was calculated to be 1,258 with a range of 698 to 1,937. Thus 13 percent of the droplets appear to have penetrated the dense forest cover which was estimated to average about 80 percent complete with the individual stations ranging from 75 to 90 percent (fig. 1). Data indicating the relative number of droplets in 3 size groups which passed through the forest cover are presented in table 3. Twenty-four percent of the droplets in the 5 to 25 micron range reached ground level while only 3 to 4 percent in the 25 to 100 and 100 to 300 micron range were recovered. The droplets measuring 5 to 25 microns in diameter thus appear to have passed quite readily through the canopy of relatively dense tropical forest and in all probability the destruction of the mosquitoes which was observed was due largely to this fraction of the spray. Most of the larger droplets appear to have been deposited on the high foliage of the forest canopy.

TABLE 3.—*Droplet size distribution of the spray produced by the torpedo plane equipment in test II*

	Droplet diameter in microns			Total
	5-25	25-100	100-300	
Average number of droplets per square inch in the open.....	587	556	115	1,258
Estimated percent by volume.....	.2	12.8	87	100
Average number of droplets per square inch at forest stations.....	138	17	5	160
Percent of droplets passing through forest cover.....	24	3	4	13

TEST III

Test III was performed on Guam, using a C-47 Army transport equipped as previously described. The spray produced by this equipment is composed of droplets which are considerably larger than those produced by the equipment on the torpedo plane. Consequently, the number of droplets is much smaller for an equivalent volume of spray solution. The airplane was operated at a speed of approximately 140 miles per hour at an altitude of 150 to 200 feet. The spray solution was discharged at the rate of 200 quarts per minute along parallel flight lines 175 feet apart. Aerology balloons anchored at tree-top elevation were used to guide the pilot in spacing his flight lines as in the previous tests. The terrain was flat, gently sloping, and covered mostly with jungle growth 40 to 50 feet high. Approximately 1 square mile was treated. The spray solution contained 5 percent DDT dissolved in 25 percent Velsicol and 75 percent Diesel oil. It was applied at the rate of 4 quarts per acre, twice the volume of spray material per acre used in the 2 preceding tests, but since the solution contained only one-half as much DDT the amount of DDT per acre remained the same (0.4 lb. per acre).

Mosquito counts were made at 10 marked stations spaced 50 yards apart along a line extending across the middle of the area to be treated. The airplane flew at right angles to this line. All the collecting stations were located in the jungle about 50 feet from the edge of a clearing. A natural population of *Aedes pandani* Stone, which is an active daytime biter, was used as the test mosquito. This was the only species available in sufficient numbers for such a test. Counts were made as in test I. The number of spray droplets actually reaching the test area was determined by the smoked slide technique previously described. One slide was exposed on the ground in the jungle at each mosquito station and another directly opposite each station in the clearing. The slides were left for about 1 hour after spraying was completed in order to collect the very small, slow-settling droplets. A few additional slides left for 6 hours showed no increase in the droplet count.

A summary of the mosquito counts before and after the spraying, droplet counts per square inch for each of the stations and an estimate of the amount of cover of vegetation present are presented in table 4. The average total count of mosquitoes for the 10 stations was 121 for the 13 observations before treatment with a range of 57 to 162. The maximum count of 162 was obtained on the day before the test. Two hours after the spraying was completed the total count was 5, a reduction of 97 percent. The mosquito population remained at this low density for about 1 week. Fifteen days after treatment the count had increased to 33. *A. pandani* larvae are found only in the leaf axils of cer-

tain plants, particularly the broad leaf pandanus. Ten pandanus trees were examined for larvae 3 days after the test and dead larvae were found in 7 of them. Two of them contained living larvae. Pooled water from all of these trees did not kill *A. pandani* larvae when tested in the laboratory.

TABLE 4.—*Adult mosquito test III*

Station	Mosquito counts									Droplet count per square inch	Percent cover of vegetation
	Before treatment			After treatment							
	June 30–August 6 (average 13 counts)	Range	1 day before	2 hours	Days						
					1	3	6	9	15		
1-----	17	7– 27	21	1	0	0	0	5	4	48	85
2-----	11	5– 26	15	2	0	0	3	1	3	24	85
3-----	25	2– 53	45	0	0	0	0	3	4	140	75
4-----	14	4– 38	38	2	0	0	0	0	10	128	65
5-----	10	5– 18	12	0	0	0	2	4	5	28	75
6-----	10	5– 16	11	0	0	0	0	4	3	12	55
7-----	16	3– 18	11	0	0	0	0	3	3	84	75
8-----	5	2– 8	2	0	0	0	0	0	0	80	45
9-----	7	3– 17	4	0	0	0	0	0	0	36	55
10-----	7	3– 18	3	0	0	0	0	0	1	132	45
All stations-----	121	57–162	162	5	0	0	5	20	33	Average 71	Average 66

The number of spray droplets reaching the ground in the open averaged 188 per square inch with a range of 104 to 312. The droplet counts in the jungle averaged 71 per square inch with a range of 12 to 140. Data indicating the relative number of droplets penetrating the jungle cover are presented in table 5. About 70 percent of the droplets under 100 microns in diameter appear to have passed through the jungle cover while only 17 percent in the 100- to 400-micron range and only 3 percent in the 400- to 800-micron range passed through. Thus the droplets less than 100 microns in diameter passed through the screen of vegetation much more readily than the larger fractions. The cover of vegetation was less dense than in either of the 2 preceding tests. The average cover was estimated to be 66 percent complete, with individual stations ranging from 45 to 85 percent.

TEST IV

Test IV was a larvicide test performed on Guadalcanal. The Navy torpedo plane and spray equipment were used. The data given in table 3 indicate the type of spray produced by this equipment. A typical breeding area for *A. farauti* was selected measuring approximately 4,500 feet long by 1,500 feet wide. The terrain was flat with about three-fourths in kangaroo grass 3 to 8 feet high and the remainder wooded. The breeding was mainly in wheel ruts in more open parts of the grassland and to a lesser extent in ruts in the marginal part of the wooded section with a light, scattered, high cover of trees and vines.

For the larval survey 76 breeding sites were selected, 18 of which were partly covered and 7 heavily covered by vegetation. The sites were well distributed over the test plot. On the day before treatment 546 dips yielded 1,739 anopheline larvae and 8,876 culicine larvae (*Culex* sp.).

The spray was applied about 3 hours after sunrise from an altitude of about 100 feet using parallel flight lines 150 feet apart. There was a light, irregular cross breeze. The rate of application was calculated to be 2 quarts per acre of 5 percent solution of DDT in Diesel oil (0.2 lb. DDT per acre). Coverage appeared to be good. Deposits of oil on water surfaces were visible even in the most concealed situations. Twenty-four hours after treatment 871 dips made at the previously sampled locations yielded 25 anopheline larvae and 1,703 culicine larvae. Almost all of the culicine larvae appeared to be newly hatched. The reduction for anophelines was from an average of 3.18 per dip to 0.03, a reduction of about 99 percent, and for culicines from 16.3 to 2.0, a reduction of approximately 88 percent. A partial survey of the test plot 3 days after treatment yielded appreciable numbers of first and second instar anopheline larvae, indicating only temporary control from this single treatment.

DISCUSSION

There seems to be no doubt that under suitable conditions natural populations of adult mosquitoes can be virtually eliminated from large areas, even from dense tropical forest, with DDT sprays released from aircraft. Probably a residuum of 50 droplets per square inch at ground level would indicate an adequate dosage (tables 1, 2, and 4). The residuum may be regarded as the resultant of 2 components, the initial concentration of droplets and the filtering action of the foliage.

In test II the average initial concentration was 1,258 droplets per square inch as indicated by the samples taken in the open, while in the wooded section it was 160, indicating that about 87 percent of the droplets were deposited on the foliage and other objects before reaching the ground. Droplets having a diameter less than 100 microns appear to pass through a forest canopy more readily than larger ones. The data would indicate that when forested areas are treated with sprays composed of relatively large droplets most of the material is deposited on the high foliage (see tables 3 and 5).

It is not likely that the mosquitoes which were under observation frequented these upper levels before sundown, so kills which became evident before this time must be attributed to the much smaller amounts which reached the lower levels. In these tests the amount of DDT deposited on surfaces at the lower levels probably was of the order of 1 to 10 micrograms per square inch as estimated from the samples obtained on smoked slides. If one assumes a height of 50 feet, this may be interpreted as representing a concentration, before deposition, of 3 to 30 milligrams per 1,000 cubic feet. A mosquito may receive a lethal dose of the insecticide either by being hit with spray droplets while they are still in the air or by contact with surfaces on which DDT has been deposited. The relative importance of the two methods was not determined in these tests.

TABLE 5.—*Droplet size distribution of the spray produced by the C-47 transport plane equipment in test III*

	Droplet diameter in microns				Total
	5-25	25-100	100-400	400-800	
Average number of droplets per square inch in the open.....	30	50	95	13	188
Estimated percent by volume.....	(1)	(1)	35	65	100
Average number of droplets per square inch at forest stations..	20	35	16	.4	71.4
Percent of droplets passing through forest cover.....	67	70	17	3	38

¹ Total about 0.3 percent.

The foregoing considerations suggest that satisfactory results might be obtained with much smaller quantities of DDT if a finer spray is used. Something of this nature has been reported by Metcalf et al. (2) who used 0.08 pound of DDT per acre dispersed in droplets less than 100 microns in diameter. However, such small droplets are subject to considerable drift caused by wind and the vertical air currents which are produced by the thermal conditions common in the daytime. These factors tend to limit the effective use of such fine sprays to early morning or evening. This can be readily appreciated by examining table 6 which summarizes some of the physical relationships affecting the efficiency of sprays applied by aircraft.

TABLE 6.—*Some physical relationships affecting the efficiency of sprays applied from aircraft*

	Droplet diameter in microns			
	15	37.5	75	150
Settling rate, feet per minute ¹	1.19	7.5	30	120
Time in minutes to settle 150 feet.....	126	20	5	1.25
Distance in feet carried by 1 mile per hour wind.....	11,088	1,760	440	110
Number of quarts per acre required to produce 1,000 droplets per square inch.....	.01	.18	1.5	11.8

¹ Gibbs (6).

The estimation of the time required for a droplet to reach the ground is made difficult by the effect of air currents due to the motion of the plane and other factors. In still air, however, the droplets would reach a constant downward velocity which is directly proportional to the square of the radius (Stokes' law). This is the only component which can be readily evaluated, but it is useful in understanding the effect of wind drift. It will be observed that droplets 15 microns in diameter are extremely susceptible to wind drift since their settling rate in still air is only 1.19 feet per minute. However, the relative number of droplets produced per unit volume of spray solution is enormous. For example, an application of 0.01 of a quart per acre would yield 1,000 droplets per square inch.

It seems likely that these relationships account in large part for the erratic results which are obtained when sprays composed of such small droplets are dispersed from aircraft. On the other hand, the effectiveness of the very large droplets (300 to 800 microns in diameter) may well be questioned, for while they are not greatly affected by wind velocities up to 10 miles per hour the number of droplets produced per unit volume of spray solution is relatively small. This is well illustrated in test III in which the average droplet count was only 188 per square inch. By comparison, test II yielded 1,258 droplets per square inch in spite of the fact that the spray solution was applied at only one-half the rate.

It seems probable that whatever effectiveness such coarse sprays may have is to be attributed to the contamination of exposed surfaces with which mosquitoes may later come into contact.

Unfortunately, it was not possible to measure the effectiveness of this surface deposit in test III since the slide samples demonstrated the presence of a fraction of small droplets in the spray which actually penetrated to the level where the mosquitoes were. The reduction in mosquito counts which took place within 2 hours of application can be attributed more plausibly to this fraction.

SUMMARY AND CONCLUSIONS

1. Four field tests are described, three for the control of adult mosquitoes and one for larval control. The DDT was sprayed in oil solution from heavy aircraft (Navy torpedo plane and a C-47 Army transport).

2. Four-tenths of a pound of DDT per acre was sufficient to kill practically all of natural populations of adult mosquitoes even in dense tropical forests.

3. Average spray droplet counts of 49, 160, and 71 per square inch were obtained at ground level in the forested areas where mosquito counts were made. This represents the residuum of spray droplets after the spray cloud has passed through a forest canopy. Probably a residuum of 50 droplets per square inch would indicate an adequate dosage.

4. The data indicate that droplets less than 100 microns in diameter pass through forest and jungle cover more readily than larger droplets.

5. Two-tenths of a pound of DDT per acre was sufficient to kill 99 percent of the larvae of *A. farauti* in a test plot of approximately 160 acres. A single application gave only temporary control, larvae being again present in appreciable numbers a few days after treatment.

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Requarth, William H., Commander (MC) USNR (Inactive) (*Emotional Disturbances Encountered in Carrier Pilots*, p. 253). B. S., University of Illinois, 1936; M. D., 1939, and M. S. in surgery, 1940, University of Illinois College of Medicine. Intern, St. Luke's Hospital, Chicago, Ill., July 1938-July 1939; fellow in surgery and instructor in surgical anatomy, University of Illinois College of Medicine and Research and Educational Hospital of the University of Illinois, Chicago, 1939-40; resident in surgery, Cook County Hospital, Chicago, 1940-41. Appointed assistant surgeon, USNR, 2 Aug. 1941. Served at U. S. Naval Submarine Base, Pearl Harbor, T. H., and at U. S. Naval Air Experimental Station, Philadelphia, Pa. Released from active duty 3 Apr. 1946. Fellow: American College of Surgeons; member: Illinois State Medical Society, Chicago Medical Society, Mississippi Valley Medical Society, and American Society for Surgery of the Hand.

Reuter, Frederick L., Commander (MC) USNR (Inactive) (*Rat-Bite Fever*, p. 333). B. S., Tulane University of Louisiana, 1935; M. D., Tulane University of Louisiana School of Medicine, 1939. Intern, July 1939-Jan. 1941, and resident in medicine, Jan. 1941-, Charity Hospital, New Orleans, La. Appointed assistant surgeon, USNR, 5 Aug. 1941 from Louisiana. Served at U. S. Naval Mobile Hospital No. 2 and on U. S. Fleet Hospital No. 116 and U. S. S. *Belle Isle*. Released from active duty 7 May 1946.

Saferstein, T. Harry, Lieutenant Commander (MC) USNR (Inactive) (*Penicillin Therapy in Relapsing Fever*, p. 238). M. D., University of Kansas School of Medicine, 1930. Intern, Broadlawns Polk County Public Hospital, Des Moines, Iowa, 1930-31, and Menorah Hospital, Kansas City, Mo., 1931-32;

private practice, St. Joseph, Mo., 1932–43. Appointed passed assistant surgeon, USNR, 13 Sept. 1943. Specialty: Internal medicine. Served 18 months in the Mediterranean Theater. Released from active duty 21 Mar. 1946. Staff, St. Joseph's Hospital, St. Joseph, Mo. Member: American Medical Association, Missouri State Medical Association, Buchanan County Medical Society, and St. Joseph Clinical Society.

Saunders, George M., Lieutenant Commander (MC) USNR (Inactive) (*Long-Term Observation of Plasmodium Vivax Malaria in the Returned Serviceman*, p. 352). A. B., University of Wisconsin, 1923; M. D., Harvard Medical School, 1925. Intern, Harper Hospital, Detroit, Mich., 1925–26, and Massachusetts General Hospital, Boston, 1926–28; tropical and preventive medicine, working with the Rockefeller Foundation and the Leonard Wood Memorial, Africa, West Indies, and Far East, 1930–40; helped to organize the medical service for the air route across Africa, Pan American Airways, 1941; assisted in organizing and developing the Division of Health and Sanitation of the Office of the Coordinator of Inter-American Affairs, 1942, and was director of the Division's work in Brazil, regional director after November 1942 for Brazil, Paraguay, Peru, Bolivia, and Chile. Appointed surgeon, USNR, 3 May 1944. Served at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Released from active duty 25 Feb. 1946. Assistant professor of preventive medicine, Washington University School of Medicine, May 1946–; consultant in tropical diseases, ward medical services, Barnes Hospital, St. Louis, Mo., Dec. 1946–. Diplomate: National Board of Medical Examiners.

Shaul, John F., Lieutenant Commander (MC) USN (*Penicillin Therapy in Relapsing Fever*, p. 238). B. S., Lafayette College, 1930; M. D., New York Medical College, Flower and Fifth Avenue Hospitals, 1935. Intern, Essex County Hospital for Contagious Diseases, Belleville, N. J., July 1935–January 1936; Newark City Hospital, Newark, N. J., 1936–38; Children's Hospital, Washington, D. C., 1938–39; children's medical service, Bellevue Hospital, New York, N. Y., January 1938–July 1939; associate pediatric consultant, Newark Eye and Ear Infirmary, Newark, N. J.; assistant attending pediatrician, Mountinside Hospital, Montclair, N. J.; assistant pediatrician, Hospital of St. Barnabas and for Women and Children, Newark, N. J.; clinical assistant visiting physician, children's medical service, Bellevue Hospital, New York City; private practice, Bloomfield, N. J., 1940–. Appointed assistant surgeon, USNR, 16 July 1942 from New Jersey; assistant surgeon, USN, 12 Oct. 1946. Specialty: Pediatrics. Served at U. S. Base Hospital, No. 9, Oran, Algeria, and in the out-patient department, U. S. Naval Hospital, Parris Island, S. C. Fellow: American Academy of Pediatrics; member: American Medical Association, Medical Society of New Jersey, and Essex County Medical Society. Diplomate: American Board of Pediatrics.

Smalley, Raymond E., Lieutenant (MC) USNR (*Symptoms and Management of Arterial Hypertension Among Naval Personnel*, p. 287). B. A., State University of Montana, 1934; M. Sc. in physiology, B. M., and M. D., Northwestern University Medical School, 1939. Intern and resident, Cincinnati General Hospital, Cincinnati, O., July 1939–July 1941; fellow, Mayo Clinic, Rochester, Minn., July 1941–Dec. 1943. Appointed assistant surgeon 7 Feb. 1944 from Minnesota. Specialty: Internal medicine. Served at U. S. Naval Hospital, San Diego, Calif., and U. S. Naval Hospital, Corona, Calif. Released from active duty 9 Sept. 1946. Staff, Billings Clinic, Billings, Mont. Member: American Medical Association, Minnesota State Medical Society, California Medical Association, Medical Association of Montana.

Smith, Donald S., Lieutenant Commander (MC) USN (*Chronic Asthma, Results of Treatment in 100 Cases*, p. 302). A. B., University of Michigan, 1931; M. D., University of Michigan Medical School, 1934. Resident, University Hospital, Ann Arbor, Mich.; instructor in internal medicine, University of Michigan Medical School, 1936-38; staff, Pontiac General Hospital and St. Joseph Mercy Hospital, Pontiac, Mich.; consultant in internal medicine, Pontiac State Hospital, Pontiac, Mich. Appointed assistant surgeon, USN, 17 Oct. 1942, from Michigan. Specialty: Internal medicine. Served at U. S. Naval Hospital, St. Albans, N. Y., 1944-46. Fellow: American College of Physicians and American Medical Association; member: Michigan State Medical Society, Michigan Society of Allergists, and Michigan Trudeau Society. Diplomate: American Board of Internal Medicine.

Stalnaker, Paul R., Captain (MC) USN (Retired) (*The Treatment of Renal Colic with Special Emphasis on Crystalluria*, p. 297). M. D., University of Texas, Medical Branch, 1904. Appointed assistant surgeon, USN, 3 May 1905. Specialty: Urology. Served on U. S. S. *West Virginia*, U. S. S. *North Dakota*, U. S. S. *Columbia*, and U. S. S. *Pennsylvania*; commanding officer, Hospital Corps Training School, Newport, R. I., during World War I, and at U. S. Naval Hospital, Guam; and chief, urological service, U. S. Naval Hospital, Philadelphia, Pa., 1926-30. Fellow: American College of Surgeons and American Medical Association; member: American Urological Association.

Wagner, Carruth J., Senior Assistant Surgeon USPHS (*Use of Wangenstein Suction Aboard Ship*, p. 343). A. B., University of Omaha, 1937; B. S. in medicine 1938, and M. D., 1941, University of Nebraska College of Medicine. Intern, U. S. Marine Hospital, Seattle, Wash., July 1941-July 1942. Specialty: General surgery. Served on U. S. S. *Taney* and U. S. S. *Wakefield* and at U. S. Marine Hospital, San Francisco, Calif. Fellow: American Medical Association.

Walters, Waltman, Captain (MC) USNR (Inactive) (*Hemorrhagic Ulcerative Gastrojejunitis Thirty Years After Gastro-enterostomy for Congenital Pyloric Stenosis*, p. 330). B. S., Dartmouth College, 1917; M. D., Rush Medical College, 1919; M. S. in surgery, University of Minnesota Medical School, 1923; D. S., Dartmouth College, 1937; LL. D. (honorary), Hahnemann Medical College, 1942. Intern, St. Luke's Hospital, Chicago, Ill., Dec. 1918-June 1920; fellow, Mayo Foundation, 1920; assistant surgeon, 1922-24, and surgeon, 1924-, and head of Division of Surgery, Mayo Clinic, Rochester, Minn.; associate professor of surgery, 1930-36, professor of surgery, 1936-, Mayo Foundation, University of Minnesota. Appointed surgeon, USNR, 18 Jan. 1936 from Minnesota. Specialty: Surgery. Served at U. S. Naval Hospital, Corona, Calif., and U. S. Naval Hospital, Philadelphia, Pa., and as surgical consultant, Third Fleet. Released from active duty 9 Feb. 1946. Fellow: American College of Surgeons; member: American Medical Association, American Surgical Association, Southern Surgical Association, Western Surgical Association, International Society of Surgery, American Society for Clinical Surgery, Central Surgical Association, Minnesota State Medical Association, Minnesota Surgical Association, Minnesota Academy of Medicine, Olmsted-Houston-Fillmore-Dodge Counties Medical Society, Southern Minnesota Medical Society, Board of Mayo Properties Association; Board of Governors, Mayo Clinic; National Advisory Cancer Council (1941-42). Diplomate: American Board of Surgery and American Board of Urology. Chairman, editorial board, *Archives of Surgery*, 1940-; editor in chief, *Lewis' practice of Surgery* 1941-.

Warren, Shields, Captain (MC) USNR (Inactive) (*Medicine at the Crossroads*, p. 219). A. B., Boston University, 1918; M. D., Harvard Medical School, 1923. Assistant professor of pathology, Harvard Medical School; pathologist to New England Deaconess Hospital, Harvard Cancer Commission, New England Baptist Hospital, Pondville State Hospital for Cancer; director of State Tumor Diagnosis Service. Appointed surgeon, USNR, 1 Oct. 1940 from Massachusetts. Specialty: Pathology. Served as director of laboratories, Lahey Clinic, Boston, Mass., and officer in charge postgraduate instruction of naval medical officers at Lahey Clinic; member, Reserve Consultants Board to the Bureau of Medicine and Surgery, U. S. Navy. Released from active duty 27 Aug. 1946. Member: American Board of Pathology, American Association of Pathologists and Bacteriologists, American Association for Cancer Research (vice president, 1941-42; president, 1942-46), American Society for Experimental Pathology (secretary-treasurer, 1934-37; vice president, 1939-40; president, 1940-41), Society for Experimental Biology and Medicine, American Society of Clinical Pathologists, Massachusetts Medical Society, American Medical Association, New England Pathological Society, American Association for the Advancement of Science. Member of editorial staffs of *New England Journal of Medicine*, *Cancer Research*, *American Journal of Pathology*. Consultant, Board of General Tumor Registry of National Research Council. Author, *Medical Science for Everyday Use*, Lea & Febiger, 1927; *Pathology of Diabetes Mellitus*, Lea & Febiger, 1st edition, 1930, 2d edition, 1938.

Wilson, Charles S., Lieutenant, H(S) USNR (Inactive) (*Observations on the Dispersal of DDT from Aircraft for the Control of Mosquitoes*, p. 368). B. S. in entomology and parasitology, 1932; M. S. in entomology and parasitology, 1935, University of California. Junior entomologist, May 1938-Aug. 1939, assistant entomologist, Aug. 1939-Oct. 1942, and associate entomologist, Oct. 1942-July 1943, Bureau of Entomology and Plant Quarantine, U. S. Dept. of Agriculture. Appointed lieutenant, junior grade, H-V(S) USNR, 4 Sept. 1943. Served at U. S. Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md., and with the Third Fleet. Released from active duty 12 Dec. 1945. Member: Entomological Society of America, Entomological Society of Washington, D. C., and American Association for the Advancement of Science.

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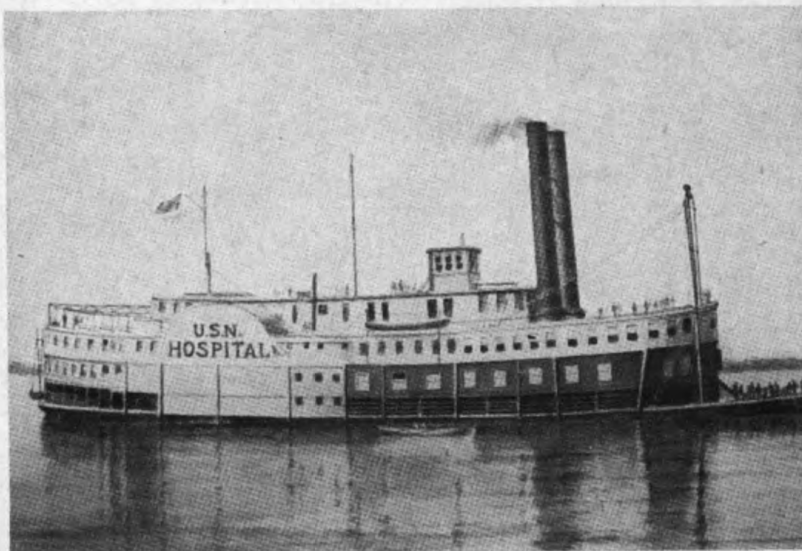


MAY-JUNE 1947

Bimonthly

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112



COVER PHOTOGRAPHS

The U. S. Navy's Hospital Ship *Red Rover*. This vessel which performed wonderful service on the Mississippi and inland waters during the Civil War was commissioned in 1862. She was on active service until 1865. She was a converted Mississippi River steamer, officially described as of wood, fourth rate, tonnage 786, draft, deeply laden, 8 feet. Speed upstream 9 knots, two engines, diameter of cylinder 28 inches and with five boilers. She had a large ice box, laundry, elevator, operating room, gauze blinds at the windows, special kitchens, and many other facilities for the care of the sick and wounded. She carried probably the first female nurses to serve aboard ship in the Navy.

The U. S. S. *Relief*. This vessel was laid down in 1918 as a hospital ship and had everything that planning and money could give to make her an ideal vessel for her work. For many years she rendered valuable service to the fleet in peacetime and this was continued during the war when in the Pacific theater she carried thousands of wounded.

—*Official U. S. Navy Photos.*

TABLE OF CONTENTS



PREFACE	Page III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Burns—<i>H. Lamont Pugh</i>	391
The Distribution and Use of Human Whole Blood in the Pacific War—<i>Herbert R. Brown, Jr.</i>	396
Emotion, the Etiologic Relation to Illness—<i>Elmer L. Carenny</i>	421
Naval Medical Specialists Units; a Proposed Plan for Their Reorganization and Continuation—<i>Richard A. Kern</i>	429
Medical Specialists in Naval Service—<i>Paul Titus</i>	438
Treatment of Acute Acromioclavicular Dislocations—<i>Walter A. Gunther and William E. Snell</i>	444
Single Injection Therapy for Gonorrhea—<i>Turner Camp</i>	451
Nummular Eczema and Prostatitis: Its Treatment With Penicillin—<i>Cedric C. Carpenter, Chester R. Nuckolls, and Joseph S. Dyke</i>	453
Psychiatric Evaluation of the Naval Delinquent—<i>Louis D. Boshes</i>	458
An Evaluation of a Physical Training Program at a Naval Air Station—<i>John G. Stubenbord, 3d</i>	473
Observations on the Production of Hydrogen Sulfide by <i>Shigella Alkaliscens</i>—<i>LaVerne A. Barnes and Joan E. Casterline</i>	478
Army-Navy Medical Matériel Coordination—<i>Vernon W. H. Campbell</i>	481
A Critical Analysis Obtained From 873 Electroencephalographic Examinations—<i>Ralph Rossen</i>	494

EDITORIALS

Fundamental Differences in the Field of Medicine in World War II and Previous Wars	504
Smallpox and Blindness	505
Tetanus and Military Medicine	505
Genetics and Intelligence	506
A Plea for Pathologists	507

CLINICAL NOTES

Idiopathic Thrombosis of the Axillary Vein—Walter R. Miller and George F. Woelfel	Page 508
Tuberculosis Pericarditis in a Case of Acute Hematogenous Tuberculosis—C. Louis Gilbert and Richard D. Haines	514
Accidents Resulting From Loose Dental Objects in the Mouth—Hal C. Hutchins	517
Salivary Calculus in the Submaxillary Duct and Its Removal—William F. Cahill	519
A Case of Gas Gangrene of Neck Following Extractions—Cyrus E. Warden ..	521
Cerebrospinal Fever Complicated by Extensive Thrombotic Gangrene of the Skin and Subcutaneous Tissues, With Recovery—Morris Steiner ..	523

MEDICAL AND SURGICAL DEVICES

Malaria Control; Description of a Compressed Air Sprayer—Russell E. Morgan, Raymond R. Sheppard, and Garold S. Barnett	529
---	-----

BOOK NOTICES

An Atlas of the Commoner Skin Diseases, Semon—A Textbook of Clinical Neurology, Nielsen—Clinical Hematology, Wintrobe—A Primer for Diabetic Patients, Wilder—Nutrition and Diet Therapy, Proudfit—Electrocardiography in Practice, Graybiel and White, with assistance of Wheeler and Williams—Textbook of Psychiatric Nursing, Noyes and Haydon—Acrylics, Tylman and Peyton—The Eye Manifestations of Internal Diseases, Tassman—Early Ambulation and Related Procedures in Surgical Management, Leithauser—Disorders of the Blood, Whitby and Britton—Root Canal Therapy, Grossman—Hygiene, Meredith	536
---	-----

PREVENTIVE MEDICINE

Report of Investigation of Health Hazards in Connection With the Industrial Handling of Thallium—Howard K. Sessions and Sidney Goren	545
Long-Term Observation of Plasmodium Vivax Malaria in the Returned Serviceman; Part II—Anthony A. Bianco, George M. Saunders, Arnold S. Levine, and Robert Cohn	550
NOTES ON CONTRIBUTORS	569



ADDRESS YOUR REPLY TO
BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT, WASHINGTON 25, D. C.
AND REFER TO NO.



WASHINGTON 25, D. C.



1 May 1947

Fellow Officers of the Medical Department:

One of our most important problems is that of postgraduate training. Only by providing and taking advantage of every opportunity for professional advancement can we give the best professional service to the officers and men of the Navy.

Postgraduate training of medical officers was begun by Surgeon General Rixey in the early years of this century. One of the most significant advances was made under Surgeon General Riggs in 1930 when a survey to ascertain the specialist needs of the Navy was made and an Advisory Board was formed to see that specialists were trained to fill these needs. This Board has been in existence since that time and has continued to provide knowledge as to the current number of specialists required and recommendations as to training to meet these requirements.

Interest in the subject of specialization in medicine is now greater than at any previous time. In addition to the various medical specialties, training has been carried on by dental officers in dental fields, and a number of Nurse Corps officers have been kept under training in such work as anaesthesia, dietetics, psychiatric nursing, and other special nursing fields. The School of Hospital Administration at the National Naval Medical Center at Bethesda is engaged in the training of Hospital Corps officers.

The training of interns is being made more uniform so that all naval hospitals will give the same instruction and experience. The highest standards for intern training are being maintained.

It is important to know that hospitals are approved for residency training in individual specialties, and not necessarily for all specialties. Thus a hospital may be approved for ophthalmology and not for syphilology or dermatology. In other words, approval of a hospital for residency training does not mean for all specialties, but only for those for which the facilities, staff, and consultants are available to meet the requirements for residency in the specialty. I mention these points particularly, as there has been widespread misunderstanding in regard to it.

A continuing study and an annual appraisal of the specialist requirements, not only of the Medical Corps, but of all groups of the Medical Department, including the newly contemplated Medical Service Corps, will be made. Based on this annual appraisal, a broad postgraduate training program will be carried on to give us an adequate number of men trained in the medical and allied specialties. This will offer an opportunity to those who have an inclination and interest in some particular field of medicine, dentistry, nursing, administration, or one of the sciences allied to medicine to apply for and be considered for postgraduate training of various types to qualify them in their chosen specialties.

Sincerely,

A handwritten signature in cursive script, appearing to read "C. J. Johnson".

Rear Admiral, Medical Corps,
Surgeon General, United States Navy.

VIII

U. S. NAVAL MEDICAL BULLETIN

VOL. 47

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No. 3

"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel."

SPECIAL ARTICLES



BURNS¹

H. LAMONT PUGH²

Rear Admiral (MC) U. S. N.

When Prometheus stole fire from heaven and bestowed it upon man, he started something. People have been getting burned ever since, and from a review of medical history insofar as it goes, it would appear that practically everything in nature from onion juice to soap-suds has been employed in the treatment of burns, an attestation in itself that no perfectly satisfactory treatment has been found.

Any consideration of burns must take into account five cardinal conditions or principles which are the determinants of both the prognosis and the treatment. They are extent, degree, where, when, and how. Until recently the least important, the last condition, i. e., how, now bids fair since the dawn of the Atomic Age to become a most important consideration. The advent of gasoline added greatly to the incidence of burns. How much and how soon this incidence will be affected by the advent of atomic power remains to be seen.

As has been a natural consequence of all wars, the stimulus for medical and surgical advancement occasioned by the late war was great. It was collectively great in proportion to the war's magnitude, and singularly great in relation to the incidence of special types of disabling entities. With respect to the management of burns this stimulus was particularly great, and significantly enough, in the Navy and Marine Corps at least, the case fatality rate of only 8.7 percent for

¹Text of remarks made upon burns as part of a Symposium on Fractures and Other Traumas conducted during the Clinical Congress of the American College of Surgeons in Cleveland, Ohio, 17 December 1946.

²Deputy and Assistant Chief of the Bureau of Medicine and Surgery, Navy Department.

burns during World War II as compared with the case fatality rate of 22.9 percent in World War I (a difference of 14.2 percent) is plainly indicative of an improvement in our methods of burn management. While perhaps not all of this improvement can be attributed to measures or principles born of the late war's stimulus but must in some measure be ascribed to progress made upon this score during the interval between, it is nevertheless of further significance that a fatality rate of 17.4 percent in 1942 dropped to about 6 percent in 1944 and 1945, thus definitely indicating improvement ascribable to the war's stimulus. Figures provided by the Army closely parallel those of the Navy. Somewhat paradoxically perhaps, however, it must be said that whatever change our concept with respect to burn management may have undergone during World War II, that change was wrought in an appreciable measure at least by what we unlearned rather than by what we learned.

We are still short of an ideal regimen in the treatment of burns. There naturally remains a good deal of difference of opinion among the various groups and clinics with respect to what constitutes the best burn regimen, save that practically all are in agreement that simplicity should be a prime requisite. In any event, whether incident to or coincidental with, the evolution of World War II by either rejection or acceptance, certain principles apparently became fairly well standardized. They resolve themselves into three categories, namely, general, local, and rehabilitation and may now be regarded as constituting the presently popular concepts with respect to burns.

To condense for the sake of brevity, it may be said that during the years of the late war the course which has led to the present status of burn management was high-lighted by recognition of the following several principles.

GENERAL

With respect to general measures, it must be said that:

1. A more intelligent appraisal of the value of blood plasma and a more general realization of its limitations have been evolved. While the sheet anchor in the management of shock is blood plasma, plasma alone is not sufficient in severely shocked cases. Certain other elements are essential as a complement to plasma in order that the most effective defense against or treatment of shock may be provided and conditions most favorable to healing may be maintained. Regardless of what scientists say to the contrary, supplementary use of an extract of whole adrenal cortex makes it possible to successfully cope with shock in stages beyond the reach of plasma alone. At least that is my conviction. Concentrated albumin too, certainly has its indi-

cations and advantages in the management of burn shock. Based upon sound reasoning, the use of an amino acid solution or casein hydrolyzate as a means of maintaining the blood protein balance is gaining popular favor and may one day supplant plasma completely. Buffers to maintain a proper acid base balance have moreover to be taken into account in a well-ordered regimen as do hormonal principles such as Seventeen Keto-Steroid.

2. The importance of maintaining a positive nitrogen balance by either oral or parenteral administration of protein has come to be more generally recognized. A high protein diet is in order. Check the patient's nonprotein nitrogen. The protein intake should equal or exceed the output. If the output exceeds the intake, it indicates that the patient is using his own tissues for repair. It is moreover important that the diet be adequate from the standpoint of vitamin content, particularly of thiamine and ascorbic acid.

3. The essentiality of whole blood transfusions in certain cases has come to be more generally recognized. A close check must be kept of the red blood count and hemoglobin. In certain severe burn cases a cachexia will supervene despite the most careful treatment and usually when such a state has supervened, death, sometimes months after the original burn and regardless of what is done, is the rule. Anyway, in this situation many whole blood transfusions will be necessary. Nothing will suffice in their stead and nothing will contribute more to the patient's chances of living.

4. A better understanding of the proneness of certain complications such as pneumonia to supervene has developed.

5. A more intelligent appraisal or realization of the merits and demerits of the sulfa drugs and of penicillin and other antibiotics exists.

LOCAL

The most notable advancements upon the score of local treatment of burns in recent years have been:

1. The virtual abandonment of tannic acid and other coagulants along with silver nitrate, the dyes, picric acid, the proprietary formulae, etc.

2. A return to the old emollients, vaseline, vaseline and paraffin (parawax), boric acid ointment, etc.

3. A fuller appreciation of the importance of protection of the burned area from infection and the prevention of further damage such as may result from allowing burned surfaces to oppose each other.

4. The popularization of the pressure dressing, locally. The rationale of the pressure dressing is based upon three important prin-

ciples: First, the prevention of circulatory stagnation and of fluid loss, along with the support of the part; second, by being left alone, the risk of introduction of secondary infection is greatly reduced; and third, the elimination of the painful ordeal of repeated changing of the dressings early is most gratifying to the patient.

5. The pronounced trend toward early skin grafting and the popularization of the patch graft. Generally skin grafting can be done within about 3 weeks, i. e., when a cherry red base obtains. Early skin grafting has come to be instituted more and more freely, not primarily as a plastic procedure but as a conservation measure, i. e., for the purpose of preserving the deeper structures, preventing further fluid loss, preventing infection, getting granulation covered early, and conserving the general health of the patient. What type of graft is used should be governed largely by consideration of what in the hands of the particular surgeon has been found most likely to grow. Patch grafts are very popular. This method involves removing the split thickness sheet and cutting it up into small pieces rather than using a sheet type of skin graft. Infection is not nearly so likely to prevent a take when the patch graft is used. This also keeps cicatrix to a minimum.

REHABILITATION

The importance of rehabilitation of burn cases from both a sociological and economical standpoint has come to be more and more fully realized but is still far too frequently neglected. Physiotherapy and active motion to the extremities should be instituted early. Passive motion under anesthesia may be used to advantage. Burns involving the hands frequently require the utmost patience and perseverance on the part of both surgeon and patient. Here is frequently a challenge of the first magnitude but so is the incentive extremely great. A well-ordered hospital will have a "hand" board comprised of an orthopedic surgeon, plastic surgeon, and neurosurgeon. It will be the function of this board to collaborate upon the matter of salvage and restoration of function of burned hands.

PROPHYLAXIS

The development and provision of prophylactic measures in the form of special clothing and local applications to meet the needs of a rapidly changing world of today and the contemplated changes of tomorrow were born of and given impetus by the late war. Needless to say our efforts toward prevention of and improvement in the treatment of burns will be continued. With the aid of research we have made great advances in the way of protective covering and local applications as prophylactic measures against burns among military and naval personnel and in industrial pursuits.

And so the gamut of measures relevant to burn management would appear to have been run all the way from the prophylactic, through the therapeutic, to indeed the post mortem as evinced by the advertising agent who, whether unwittingly or not, on the face of a cliff containing an inscription of a religious sect the words, "What will you do when you die?", placed a placard bearing the enjoinder, "Use Arnica Salve, it's good for burns!". Maybe he had something there at that!



NITROGEN METABOLISM OF PRESCHOOL CHILDREN

Authors' summary and conclusions.—Nitrogen metabolism has been studied in eight preschool children on protein intakes of between 45 and 58 gm. per day. The basal diet was supplemented with ascorbic acid, potassium citrate, and orange juice as indicated. The results were as follows:

1. The nitrogen intake was probably not a factor influencing nitrogen retention, since from 88 to 94% of the ingested nitrogen was absorbed, and only 3.3 to 9.8% was retained.
2. The nitrogen retention was not significantly altered by the addition of 100 mg. of ascorbic acid to a diet containing 23 to 25 mg. of the vitamin.
3. The nitrogen retention was not significantly altered by the addition of 3.38 gm. of potassium citrate to the diet.
4. The percentage retention of nitrogen was highest in all four subjects tested, when an orange juice supplement, equivalent in ascorbic acid and citrate value to the crystalline supplements, was added to the basal diet.—LEW, M. S., CLAGGETT, D. D., MEYER, F. L., and HATHAWAY, M. L.: Nitrogen metabolism of preschool children. *J. Nutrition* 31: 665-673, June 1946.

THE DISTRIBUTION AND USE OF HUMAN WHOLE BLOOD IN THE PACIFIC WAR ¹

HERBERT R. BROWN, JR.

Lieutenant Commander (MC) U. S. N. R.

From the destructive processes of war there always seem to emerge some bright and encouraging elements, as if there were somewhere an attempt at counteracting the disasters. The perfected distribution of human whole blood by air, over thousands of miles in the Pacific theater, through hot tropical climates, to the front lines of battle deserves to be included in that list of "bright and encouraging elements."

This complete report, both historical and factual, is being made in some detail, for it is inestimable just how many lives were saved by the ready availability of this human whole blood during the war. From the results and data herein related this report will act as a guide to the many civilian blood banks and whole blood programs which now are being contemplated and started. Also contained is the report on one of the largest groups of data on transfusions and their reactions in the history of blood transfusions.

HISTORY OF THE NEED FOR THE PROJECT

The war clouds gathered in 1939 and 1940 and the medical profession of the combined services along with that of the civilians became greatly concerned over the preparation for war if and when it should come. The usage of plasma had already proved itself a most valuable agent in restoring the circulating blood volume in the shock state (secondary shock resulting from trauma); accordingly, all emphasis was placed on a plasma program sponsored by the American Red Cross and supervised by the Army and Navy Medical Departments, with expert technical advice from members of the National Research

¹ The following officers did much of the basic work at the onset of this program and for its entire operation in the United States; they are: Rear Admiral Daniel Hunt (MC) U. S. N., for his cooperation in the organization of the whole blood program; Capt. Lloyd R. Newhouser (MC) U. S. N., for his work in the organization of the whole blood program; Lt. Comdr. Henry S. Blake (MC) U. S. N. R., for his continued management of the whole blood program in the United States as Technical Director and Advisor to the American Red Cross; Lt. Comdr. Anthony E. Allegrini (MC) U. S. N. R., for the coordination and management of the West Coast Blood Bank Facility and Lt. (jg) George E. Nicholson (HC) U. S. N., Assistant to the Officer-in-Charge of the Distribution Center at Guam.

Council Subcommittee on Blood and Blood Substitutes, and the National Institute of Health. Thus, in discussion and planning at such meetings as that of the Human Serum Association at Cleveland in June 1941, the problem of drying and storing human plasma was the paramount factor of consideration.

The whole blood requirements at the beginning of the war were to be cared for in the individual hospital, ship, or station where the bleeding of donors was to be done according to demands. This plan seemed at that time to cover all of the necessary exigencies.

The wars began, and with the advent of the Solomon Islands and north African campaigns of August and November 1942 respectively, much was learned as to the additional needs of modern medicine in battle. It was evident from the very first of the conflicts with the enemies in both theaters that whole blood in addition to plasma would be needed in increasing quantities. Considerable assistance was obtained from the British in North Africa who had previous war experiences due to their early entry into the war.

In the Mediterranean Theater, Col. E. P. Churchill, (MC) AUS, set forth appeals for more and more whole blood procurement to meet the needs of battle. The emphasis grew stronger, and through the untiring efforts of Maj. E. Sullivan (MC) AUS, in addition to stimulus resulting from the bitter struggle at Anzio in Italy in January 1944, a blood bank was established on 23 February 1944 in connection with the 15th Medical Laboratory in Italy under the direction of Maj. J. J. McGraw, (MC) AUS, and for the remainder of the war this facility supplied the needs of that theater from their own donors in a most efficient way.

In the early Pacific warfare also, as in the bitter battles of the Solomon Islands, the need for whole blood in large quantities, from sources other than troops and fighting personnel, was demonstrated. For here under the worst tropical conditions, with malaria rampant, it was not possible to procure adequate donors to meet all demands. Early in the South West Pacific, then, blood was first obtained in part from Australia, later from the medical facilities at Hollandia, and still later from the *LST 464* which acted as a floating blood bank.

With the progress of the European war there were initial plans to be prepared to provide 1 pint of whole blood for every four to five casualties on the Normandy landings, and later this was revised to 1 pint per two casualties. There will be more discussion of this later.

In the main the Pacific warfare differed considerably from the European. In the Pacific conflict, as it reached its height with multiple island invasions, the essential difference was that large scale medical care was much nearer the wounded, in the form of hospital

ships, LST's, well-equipped APH's and APA's, landing medical parties, and later the medical shore installations as well as air evacuation planes; whereas, in Europe large land territories had to be covered, and personnel, both troop and medical, was much more spread out. Take for example the campaign of an Army in France as compared with the Invasions of Tarawa or Iwo Jima where the entire plot of land was not more than a few miles long and much less wide, and yet there were really stupendous medical forces backing them up. With the attacks on such heavily fortified areas increasing, coupled with the brilliant use by the Japanese of mortar fire and other weapons, the most terrible type of wound was inflicted, with men being literally blown in two and yet still living. These patients were promptly brought to medical stations in such a state that survival seemed impossible. Accordingly, the average of 1 pint per casualty in the Pacific did not seem so heavy if the above picture is borne in mind.

With such an introduction then the need for whole blood in much larger and readily available amounts was more and more evident. Thus in August 1944 the United States Army started flying human whole blood to the European Theater of Operations, and in November 1944 the Navy began flying it to the Pacific Theater of Operation. Just prior to this, Lt. E. E. Muirhead, (MC) USNR., under the direction of Capt. A. T. Walker, (MC) USN, Fleet Medical Officer to the Seventh Fleet, maintained a remarkable and excellent blood bank service for the South West Pacific areas on the *LST 464*, where donors for this theater were obtained. All of this blood, however, had to come from service personnel. Once the problems of transportation and refrigeration were solved the supply of whole blood from donors in the United States was more than adequate to satisfy all Army, Navy, and Marine needs in all areas, without drawing upon service personnel in the forward areas, an expedient which was necessary to meet demands.

PREPARATION STAGES

Two major topics are considered and their solutions are related, as follows:

(a) EARLY TRANSPORTATION OF WHOLE BLOOD BY THE BRITISH ARMY

On 12 February 1944 in the *Journal of the American Medical Association*, Whitby (1) described the activities of the British Army Blood Transfusion Services. They had collected and distributed 8,790 pints of whole blood for the British, Norwegian, and French campaigns as well as for home forces and civilian usage. There were even wicker baskets for the containers so that parachute drops were made at Dun-

kirk. These bloods were all type "O," Kahn negative, and were shipped in insulated boxes with central water ice units. Although their system was basically similar to the eventual Navy system, much more had to be taken into consideration for the Navy's long shipments, under tropical conditions as well as other factors.

(b) INCREASING DEMANDS FOR WHOLE BLOOD IN PACIFIC THEATER AND PROBLEMS THEREIN CONCERNED

With each ensuing invasion in the Pacific from Tarawa on there were increasing demands for more and more whole blood for the Pacific Ocean areas. In order to meet these demands, and send blood from the United States, the following problems had to be solved, many of which at first seemed almost unsurmountable. They were:

Distances in the Pacific.—A first concern was the extreme distance to be transversed, with many thousands of miles between the Pacific Islands as well as thousands more from the United States.

To illustrate more fully the distances in the Pacific, here are some of the approximate mileages: San Francisco to Honolulu, T. H., 2,087 miles; Honolulu, T. H., to Kwajelein, 2,124 miles; Honolulu to Guam, 3,668 miles; San Francisco to Guam, 5,755 miles; San Francisco to Philippine Islands, 7,141 miles; and New York to Tokyo, Japan, 6,595 miles. No one understood these terrific distances better than the Naval Air Transport Service; therefore, as soon as possible they scheduled and maintained routine service from the United States to all areas, just as soon as the islands were conquered and the Navy Seabees could construct the air bases.

Thus in August 1944, when the Naval Air Transport Service was approached relative to carrying all of the shipments of whole blood from the United States to the Pacific theater, a schedule of 34 hours of actual flying time was projected from Oakland, Calif., to Guam in the Marianas where the advance base blood distribution center was to be. This schedule was always maintained. From Guam, the Army Transport Command did a fine piece of work in carrying into the Philippine Islands all of the whole blood required there throughout all of their campaigns. For the interisland transport, the Transport Air Group, a cooperative venture composed of Army, Navy, and Marine pilots and ground crews did outstanding work in flying the blood wherever needed, very often into combat areas and through bad weather. Interisland trips in the Philippine Islands were made by the 15th Army Air Force, and not infrequently the Army L5, a Cub type plane with single powerful engine, was used to fly into valleys and otherwise inaccessible areas. These planes carried blood and medical equipment in, and evacuated patients on the way out.



FIGURE 1.—Lightweight expendable refrigerator for transporting whole blood by aircraft.

The temperature problem.—The second was the tropical climate, with temperatures rarely under 90° F. (32° C.) and often as high as 130° F. (54° C.) to 140° F. (60° C.)

It was necessary to design and test an expendable refrigerator (fig. 1) which would maintain whole blood between 36° F. (4° C.) and 50° F. (10° C.) for at least 36 hours, at an average ambient temperature of 76° F. (22° C.).²

(a) The Requirements for Refrigeration: The requirements for necessary refrigeration were as follows:

(1) That the blood be maintained at a temperature not less than 36° F. (4° C.) nor greater than 50° F. (10° C.).

(2) That the refrigerated box be expendable, as light as possible, and capable of transporting about 16 pints of blood.

(3) That the blood be placed in removable racks to facilitate handling. In the design of the refrigerator, ice appeared to be the ideal refrigerant, because of its general availability, and since its use practically eliminates the risk of the blood temperature going below 36° F. (4° C.), a circumstance which might occur if dry ice were used. The latent heat of fusion of ice provides a moderately efficient heat reservoir but it was essential also to provide insulation of low density and thermal conductivity. A rapid survey of available portable refrigerators including a stainless steel vacuum jar was made, but none was found which met requirements. Several lightweight refrigerators were therefore designed and models constructed and tested. The preliminary experiments revealed that round blood trays peripheral to the ice container were the most satisfactory. Various construction and insulating materials were tried in a number of combinations. Plywood of varying thickness, pasteboard, aluminum, masonite, galvanized iron, and copper wire were tested as construction materials, and various insulating materials were investigated to determine the most efficient types. From the tests then the following design evolved: The bottles were placed in round galvanized iron metal trays through which a central galvanized iron ice cartridge passed. This unit was then placed in a double-walled box, the outer wall being made of plywood and the inner wall of pasteboard with lightweight insulation between them. To facilitate re-icing at advanced distribution centers, the ice cartridge was made removable.

(b) Testing of Trial Model: The refrigerator was tested by loading it with 16 bottles of blood, and precooling it in a cold room to 36° F. (4° C.), which required 6 to 9 hours when refrigerator and blood were warm. The ice container was then packed tightly with chipped ice and placed in a room for tests at varying temperatures.

² Construction and development of the refrigeration unit were carried out at the Naval Medical Research Institute, Bethesda, Md., under the direction of Commander E. L. Lozner, (MC) U. S. N. R., and Commander W. V. Consolazio, H(S) U. S. N. R.

The temperatures of: One, ambient air; two, the outside of a bottle on the bottom tier; three, the outside of a second bottle on the bottom tier; and four, the outside of a corner bottle on the top tier, were measured by thermocouples and a mixromax recorder. When the ambient temperature was 80° F. (27° C.), all temperatures of the surface of blood bottles remained within the limits set (36° F. (4° C.) to 50° F. (10° C.)) for 50 hours, or 14 hours beyond the specified duration of 36 hours, including a safety factor of 5° C. The total weight for the finished model was 87 pounds, completely packed with sixteen 600-ml. bottles of blood.

The preserving solution.—The third was the fact that blood banks operating in the United States rarely had used blood over a total of 7 days of age and very often the top limit was 4 days; thus, a different anticoagulant preserving solution was necessary, for it was obvious that valuable days would be lost during processing, and transportation from the United States to the various Pacific stations.

As early as 1916 it was known that the addition of dextrose to a citrated blood would aid in the preservation of the erythrocytes as described by Rous and Turner (2). In the December of 1943 British Medical Journal, Loutit and Mollison (3) stated that their citric acid, sodium citrate, and dextrose anticoagulant solution resulted in: One, improved preservation; two, the ability to autoclave the solution without caramelization occurring; and three, the sodium citrate in concentration was adequate to prevent clotting. Thus, this combination of the above constituents provided for the longest survival of the transfused red blood cell.

As a result of intensive studies of various diluting fluids, carried out by several groups of investigators working under the Committee of Medical Research of the Office of Scientific Research and Development, advisors in the National Research Council recommended a slightly modified Loutit-Mollison solution as providing for the longest survival of the cells in preserved blood.

4. *Standard type of equipment.*—Fourth, a standard type of equipment had to be set up for the entire program. The equipment for the blood bank was necessarily of the highest specification, and figure 2 is an illustration of the type of apparatus used throughout the program.

Preliminary studies on whole blood shipments.—Fifth, before starting on this program, a number of studies on older aged, refrigerated, and transported blood were necessary to finally assure those concerned with the safety of the project.

In addition to the above-mentioned considerations it was important that a few more questions be answered in a practical manner. They were namely, (1) the degree of cell break-down in actual shipments

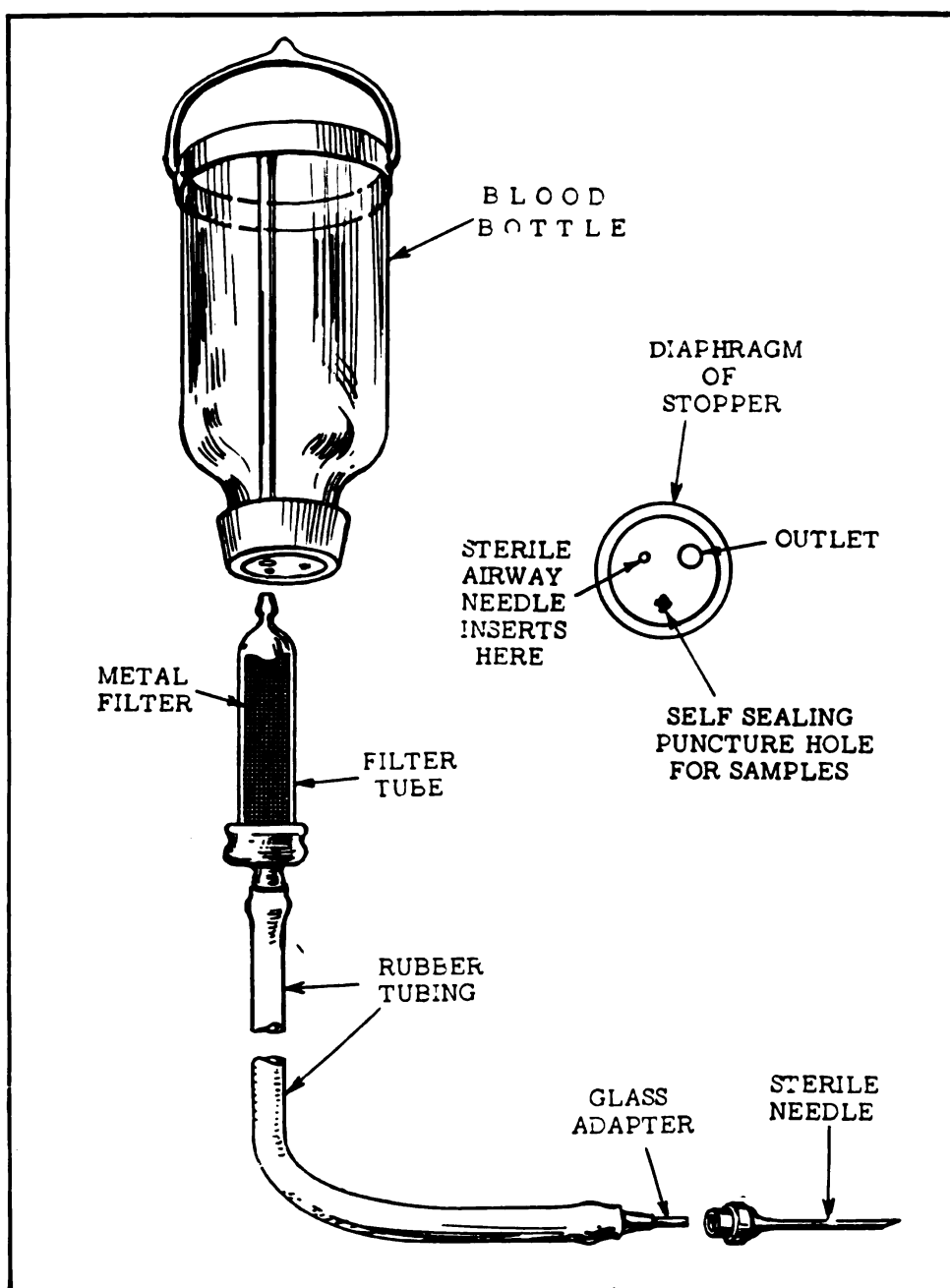


FIGURE 2.

of blood with the resulting increases in plasma hemoglobin, plasma bilirubin, osmotic fragility, and also check cross-matchings and iso-agglutinin titers.

The Naval Medical Research Institute at Bethesda attacked the above problems, using blood in the previously described 600 cc. type bottle containing the A C D or Loutit-Mollison solution, for an anti-coagulant. Blood samples used were of the following ages: (a) 10

samples under 4 days of age, as controls, (b) 8 samples 10 to 20 days of age, and (c) 35 samples 22 to 31 days of age. The bloods were drawn on the west coast and sent to Washington by air under refrigeration. Sixteen of the bloods were sent to Pearl Harbor and thence back to the United States to Washington, D. C. An analysis of the results showed that in none of the specimens did the plasma hemoglobin ever exceed 25 mgm/100 cc. In transfused patients, there was found to be mild hyperbilirubinemia which returned to normal within 24 hours. The effects in multiple transfusions were not cumulative and in only one very ill patient with a ruptured appendix and peritonitis did the bilirubin level rise as high as 3.5 mgm./100 cc. The norm for the osmotic fragility in fresh blood was 0.55 to 0.6 percent NaCl whereas with stored 21-day-old blood it was 0.70 to 0.80 percent NaCl.

All bloods were regrouped for checking the grouping processes, and no errors were encountered. The over-all iso-agglutinin titers ran as would be expected from a low of 1-32 to a high of 1-1,024 in the anti-A and anti-B agglutinins.

In an analysis of 575 different sera against known cell suspensions of groups A and B by Kettel (4) it may be seen in that series that only 1 percent of anti-A agglutinins reached a titer of 1-1,024 and but 1.5 percent to 1-512, and 5 percent at 1-256. All the other 90 odd percent were below that with the peak of 40 percent at 1-64. The anti-B titers ran universally lower, with 1 percent at 1-512 and 2.5 percent at 1-256, with its peak at 1-16. Thus, as concerns the number of possible excessively high titers anti-A and anti-B agglutinins, the chance of serious agglutinin reaction is relatively low in type "O" whole blood obtained from the donor population at large.

It has been shown in recent years that indiscriminate use of universal donor blood does not constitute as great a danger as was formerly believed. Riddell (5) reported that in France in the experience of *Tranfusion Sanguine D'Urgence* in Paris about 6,000 universal donors per year were supplied without a fatality occurring as a result of transfusion.

Slight chance of serious reaction.—Although, the chance is slight, serious reactions can and do occur from high titered group "O" universal donor blood as reported by Levine and Mabee (6) and Aubert, Boorman, and Dodd (7) who demonstrated the occurrence of intravascular agglutination and hemolysis in a significant percentage of cases following the transfusion of serum of group "O" into recipients belonging to group A.

THE BLOOD COLLECTION PROGRAM

In order to standardize the collecting of blood in the various centers all procedures were carefully set forth, and the greatest supervision

was exercised over equipment and personnel in all of their exacting functions. It should be stressed that the success of the program was entirely dependent on careful bleeding, expert check typing, pre-cooling of donor bottles, and immediate refrigeration of the blood. This was always done.

THE CONTROL OF THE WHOLE BLOOD PROGRAM IN THE UNITED STATES

This control was not especially difficult for it was merged with the plasma procurement program; thus, but for new centers to be opened on the west coast little more other than that previously discussed was needed. The centers which provided the whole blood for the Pacific Theater of Operation were San Francisco, Calif., in the first place on the donor list; Los Angeles, second; and in the following order of totals in contribution, Oakland, Calif.; Portland, Ore.; and San Diego, Calif.; those east coast centers which sent their whole blood at the cessation of European hostilities were New York, N. Y.; Brooklyn, N. Y.; Chicago, Ill.; Boston, Mass.; Philadelphia, Pa.; and Washington, D. C. (The eastern cities are not placed in order of their total donations.)

On signal from the blood distribution center at Guam to the West Coast Blood Bank Facility at San Francisco, that facility would then estimate the ability of all the bleeding centers to meet the over-all demand for blood after consulting with the technical director of the program in Washington, D. C. Thus, the load of distribution from all centers was adjusted. It is interesting to note that 80 percent of all the blood supplied to the Pacific was gathered from the west coast donor centers, for the east coast donor centers were primarily concerned with supplying blood to the European Theater of Operation up to the cessation of hostilities in that theater. Thus no small tribute is due to those centers who always met the demands of war no matter how severe they were, and very often they were very severe.

PACIFIC DISTRIBUTION

The facility at Guam in the Mariana Islands was officially known as the U. S. Naval Whole Blood Distribution Center No. 1 in contradistinction to calling it a blood bank, which implies blood collection and donor processing, for none was done at that center. The base at Guam was selected because of that island's strategic location as a central point for all future operations.

The first shipment of 5 cases of 80 pints of human whole blood arrived at Guam on 19 November 1944.

Figure 3 portrays the distribution areas much better than a written

description could, and but for a few details further discussion is not necessary.

In the Philippine Islands the U. S. Army blood-bank facilities were located at Tacloban on Leyte Island where Capt. H. H. Thorpe (MC), A. U. S., handled the difficult over-all distribution to all the other Philippine Islands.

At the time of invasions, LSTH's were mounted with blood prior to proceeding to the target, and as required, a complete blood distribution team would be put ashore with its independent 150-cubic-foot refrigerator, a portable electric generator to supply current, an ice machine, and transportation facilities in the form of truck or jeep. The team was under the direction of an officer well-trained in the proper screening and handling of whole blood, and was composed of sufficient personnel to run the unit from a mechanical as well as a biological aspect. It was overstressed to all personnel handling blood in the Pacific Theater that improperly cared for blood could easily cause fatal reactions.

FACTORS OF OPERATION

The discussion of type of equipment, preserving anticoagulant solution, and transportation has previously been dealt with; but factors of operation on Guam and in other areas are deserving of further discussion.

Guam was selected as the distribution point, because using that as a center, all future areas of operations up to and even including Japan itself were but some 1,600 miles away, or approximately 8 to 9 hours by air.

The distribution center was set up at Naval Air Base, Agana, Guam, and consisted of two Quonset huts, one of which housed the ice machine, a laboratory, an office, and the other a storage hut for the blood boxes, for in addition to the running supply an extra hundred empty boxes were maintained there in case of emergency. A covered elevated platform was built in front of the huts to keep the boxes out of the mud and to protect them from the weather and truck traffic while being unloaded from planes. Four 675-cubic-foot refrigerators were needed for the peak loads. Although, the activity started with but one refrigerator, it acquired additional units, one by one, as the demands increased, and a fifth was on order for construction when the war ended.

The center itself was situated contiguous with the air field and was but 100-odd yards from where the planes loaded and unloaded. Thus trucks were not necessary for loading and unloading the planes, and finger lifts could bring the boxes directly to the sheltered loading platform at the center.

Figure 4 shows some pictures of the physical structure of the Guam facility and also aids in explaining the phases of operation.

After the blood had been stored in the reefer and allowed to settle for 12 hours, it was then checked for hemolysis and contamination by shining a microscope lamp through the plasma layer from which the red cells had settled. Even small degrees of hemolysis can thus be detected. Clots too can readily be visualized. Hemolysis was graded

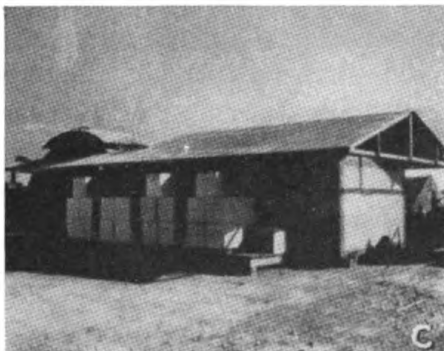
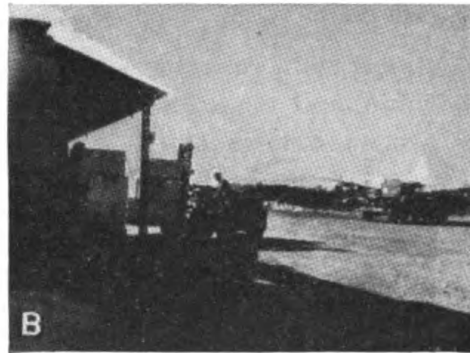


FIGURE 4.—(a) Unloading of blood boxes from plane by means of finger lift. (b) Same loaded finger lift showing proximity of the blood bank facility to the parking area for the air transports. (c) Thirty-nine boxes or 624 pints of blood ready to be opened and stored in the reefers. (d) Unloading the refrigerated boxes and placing them immediately inside the large reefers. (e) Inside view of a large reefer showing blood stored on shelves according to date. (f) Section of the laboratory.

TABLE 1.—Whole blood distribution in pints by months

ISLAND-BASED ACTIVITIES										
Date	Campaign	Leyte	Guam	Salipan	Tinian	Iwo Jima	Okinawa	Pellieu	Japan	
19 Nov.-24 Dec.	Leyte	4,256	253	128						
24 Dec.-31 Jan.	9 Jan. Luzon D-day	9,824	549	672	48			48		
1-28 Feb.	19 Feb. Iwo Jima D-day	8,480	240	2,064	112			48		
1-31 Mar.		10,304	1,364	1,712	16			32		
1-30 Apr.	1 Apr. Okinawa D-day	12,568	1,145	2,560	96	64	5,120	36		
1-31 May		15,748	1,810	2,880	480	144	12,922			
1-30 June		13,144	1,171	2,960	160	160	7,148			
1-31 July		8,256	1,068	584	98	72	848			
1-31 Aug.		7,570	612	280	48	72	1,064	32	96	
1-30 Sept.		2,936	414	376	64	48	444		96	

SHIPS										
Date	Campaign	Fleet units	Solace	Samaritan	Relief	Bountiful	Hope	Mercy	Comfort	LST 920
19 Nov.-24 Dec.	Leyte	288								
24 Dec.-31 Jan.	9 Jan. Luzon D-day	496		96						
1-28 Feb.	19 Feb. Iwo Jima D-day	784	1,216	880	1,280	1,328	1,920		1,120	1,968
1-31 Mar.		1,936	960	1,920		240	128	1,008	320	
1-30 Apr.	1 Apr. Okinawa D-day	176	560	352	328					
1-31 May		564	352	760	160					
1-30 June		80	432		112					
1-31 July		136	264							
1-31 Aug.		48								
1-30 Sept.										

SHIPS

Refuge, 100.
 Rescue, 192.
 Rescue, 144.
 Rescue, 48. Tranquility, 208.
 Benevolence, 208.

according to visual observation in terms of 1 plus, 2 plus, 3 plus, and 4 plus, with all bloods of a 2 plus classification and above discarded.

Prior to reshipment of the blood the boxes are cooled in a reefer so that the warm box will not melt ice in the central container; thus the container, blood, and ice are in a condition of maximum refrigeration when leaving the reefer.

Statistics

Total bloods received at Guam-----	177,784 pints.
Total bloods shipped at Guam-----	171,564 pints.
Losses due to all cases, hemolysis, clotting, passed expiration date, and contamination.	6,217 pints or 3.4 percent for the entire program.

Logistics

Total weight, all shipments to Guam-----	966,700 lb. or 483.35 tons.
Total cubic feet all shipments from Oakland to Guam.	65,557 cubic feet.

In table 1 it is of interest to note the amounts of whole blood distributed to various of the larger bases and how the fluctuations coincide with the peak casualty loads. The Army in the Philippines estimated their whole blood needs to be 1½ pints per wounded individual. In the Pacific Ocean Area the estimates were calculated on a 1 pint per total casualty, i. e., killed, wounded, and missing, for a working hypothesis. Both methods were very closely correct in the over-all picture.

The figures in this table do not represent the entire whole blood expenditures and only the larger medical activities are listed. The Guam and Saipan totals represent hospital requirements for casualties and many of those cases had received blood transfusions prior to their hospitalization in the Marianas; thus, the patient load in the hospitals may have been approximately five times the figures listed at any time.

Another observation on fresh casualties returning from Iwo Jima to Guam revealed that of 3,460 stretcher cases, from 1 to 3 days removed from battle and time of injury, a total of 1,878 transfusions were required, or over 54 percent of those patients required transfusion. By thus carefully following the daily casualty figures and hospital admissions in the over-all Pacific Theater on tables such as these, we were able to continually estimate the whole blood requirements.

The amounts of blood sent to hospital ships likewise give a good indication of the magnificent work that these vessels did in the treatment of as serious casualties as were seen in the entire war. It is to be noted that on the monthly issues of from 900 to 1,000 pints to some hospital ships, some of that blood was carried for "beach head" distribution, but in nearly all instances of figures below 900 pints, all of that blood was used by the individual ships themselves, in their respective monthly treatment of casualties.

The fleet needs were very difficult to estimate for units would either

need no blood or a considerable quantity. It eventually resolved itself into a matter of those larger vessels, such as aircraft carriers and others in carrying 32 to 64 pints at all times during operations so that they would not have to bleed their crews if disaster occurred.

In calculating the amount of blood used for an entire operation such as Iwo Jima for example, the amount of blood used at hospitals on Guam and Saipan, etc., in the treatment of returning casualties was likewise counted, since all of those casualties were an actual part of the cost of battle. It was possible to obtain quite an accurate total because all of the hospitals were practically cleared of patients prior to a campaign, thus, all admissions thereafter which required a blood transfusion were counted as a cost of that action. Figures in table 1 represent the actual amounts of blood supplied to an individual base, but, for example, a hospital ship lying off Okinawa might have used up much of her monthly allocation of blood there, thus, the totals for the individual islands do not reflect the entire amount which was utilized for a campaign. See table 2 for campaign totals.

TABLE 2

Area of campaign, a specific unit:	<i>Total number of bloods required for the campaign</i>
Philippine Islands.....	93, 086
Okinawa.....	44, 802
Iwo Jima.....	16, 224
To all hospital ships.....	18, 068
Fleet units.....	4, 508

REACTION REPORTS

It was realized that with the setting up and centralization of control of this project the data herein gathered would be of inestimable value to the medical profession. Having learned by experience that medical officers in combat areas could not fill out lengthy reports, it was decided that the simplest form of a report card should be used, and although this did not contain all the information to be desired, as much was requested as was thought to be practicable. Accordingly, a return addressed post card was used to gather reports from the over-all areas (fig. 5).

A total of 21,296 of these cards was returned. Many were not completely filled out but there was adequate reporting to allow for an unusually large series of analyses. In calculating the reaction rates, every reported reaction was counted; there was no shading on this issue. It may be questioned that during the heat of battle a number of transfusion reactions occurred which were not observed. This fact is acknowledged, but it is likewise to be noted, as in table 1, that the greater majority of bloods went to established base facilities, and

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**Medical Officer in Charge
U. S. Naval Whole Blood Distribution Center No. 1
Navy 926, F.P.O.
San Francisco, California**

12ND FORM 428

Whole "O" Blood Reaction Report

The shipment of blood to the Pacific Area involves many new problems. It will be appreciated if Medical Officers will fill out this card and mail.

1. Nature of case Wound from exploded detonator

2. Reason for Transfusion Loss of blood

3. Patient's blood type (dog tag) _____

4. Was there a reaction from this transfusion? YES _____ NO ✓

If YES, Mild _____ Moderate _____ Severe _____

5. Age of blood given _____ Days (See date on bottle)

6. Amount given 500 cc

7. Remarks _____

FIGURE 5.

that only during the first few "beach head days" of an operation would such hold true, for it did not require very long for hospital facilities, either ashore or afloat, to adapt themselves to a functioning routine within a relatively short period of time.

A number of considerations relative to the reaction rates will thus be considered; they are: Total over-all reaction rate, optimum age limits of blood transfused, reactions of type "O" administered blood to recipients with type "O" blood cells, blood groups as well as to types "A," "B," and "AB"; reaction rates according to various injuries;

the Rh factor; allergic type reactions; reactions from different established activities and finally observations made upon older aged bloods, some of which were made available to natives on Guam who had no other means of furnishing blood for each other due to widespread anemia among all ages of the population. This resulted mainly from hookworm infestation, malnutrition, and tuberculosis. These and many other disease states were aggravated by the long period of Japanese occupation.

TOTAL REACTION RATES

Totals for entire program: Reported transfusions, 21,296; reported reactions, 676; reaction rate, 3.1 percent.

This series of blood transfusions constitutes one of the largest on record. DeGowin and Hardin (8) reported a 4.1 percent reaction rate on a series of 1,600 transfusions, with Hoxworth and Skinner (9) the same, a 4.1 percent reaction rate on 3,077 transfusions. Wiener (10) points out that their low rates were undoubtedly due to: (1) careful typing, and (2) especial care with their transfusion equipment. It is to be remembered that all of the blood for the Pacific areas in the majority of instances was drawn and typed by experts, many of whom had 3 or 4 years' experience in blood bank work; that also the blood was never allowed to lose its refrigerated condition; and all sets were especially commercially prepared, used once and then expended, or at least not used a second time for blood transfusions. It is thus due to such simple expedients and care, as related above, which account for this low reaction rate. The major rules for safe and reaction-free blood transfusions are: (1) proper typing of blood, (2) constant and adequate refrigeration, and (3) sterile, pyrogen-free donor and recipient equipment, to which the greatest attention must always be paid.

VARYING AGES OF TRANSFUSED BLOOD

In a discussion of the optimum age at which blood may be safely transfused it is emphasized that 21 days was and still is the top figure by choice, although blood of 28 days of age and older may be and has been given with safety. It is generally agreed that the rate of red cell deterioration over the 21-day period rises rapidly, but that at the 21-day period there still remains about 85 percent of the initial red blood cell efficiency; in other words, approximately 85 percent of the red cells, when transfused, will live to act as efficient oxygen carriers provided the blood has been stored at 4° to 10° C. in acid-citrate-dextrose solution. Blood over 21 days old may be safely transfused; however, it must be borne in mind that cell survival following transfusion declines rather sharply after the 21-day storage period. (Table 3 shows reaction rate of various aged bloods.)

TABLE 3

Age in days of "O" blood	Reported transfusions	Reported reactions	Reaction, percent (approximate)
4.....	46	3	6.0
5.....	130	7	5.2
6.....	188	4	2.0
7.....	296	20	6.6
8.....	421	17	4.0
9.....	508	23	4.6
10.....	618	27	4.5
11.....	561	29	5.1
12.....	680	25	3.6
13.....	387	18	4.5
14.....	417	19	4.7
15.....	525	20	4.0
16.....	549	20	4.0
17.....	466	23	5.0
18.....	417	14	3.5
19.....	321	12	4.0
20.....	358	22	6.0
21.....	257	14	5.5
22.....	191	6	3.0
23.....	98	2	2.0
24.....	104	3	3.0
25.....	53	3	6.0
26.....	65	2	3.0
27.....	38	3	8.0
28.....	29	3	10.3
29.....	32	2	6.0
30.....	34	2	6.0
31.....	6	1	-----
32.....	6	0	-----
33.....	5	0	-----
34.....	6	0	-----
35.....	7	1	-----
38.....	1	0	-----
41.....	1	0	-----
45.....	1	0	-----
46.....	5	2	-----
55.....	1	0	-----
61.....	1	0	-----
76.....	2	0	-----
Total:			
22 days or under.....	7,336	326	4.4
23 days or over.....	495	24	4.84
All ages.....	7,831	347	4.43

ISO-AGGLUTININ EFFECTS ON THE RECIPIENTS OF ALL THE BLOOD GROUPS

In this analysis data were not obtained from all of the 21,296 reports, for many cards did not have the recipient's type recorded. The conclusions drawn from table 4 have long been anticipated, and although no severe reactions were reported as due to unusually high titered blood, it is obvious from this series that varying titers of anti-A and anti-B in the type "O" donor blood were largely responsible for the increased reaction rate. To adjust this difficulty the addition of A and B polysaccharide type-specific substances, as done by Witebsky, (11) is to be recommended to neutralize the anti-A and anti-B agglutinins. The type "O" blood used in the Pacific was highly successful and in very few instances were cross-matchings carried out. This was a matter for the individual hospital and laboratory units to work out, but all concerned, when seriously rushed, did not cross-match; of course in cross-matching types other than "O" the

recipient's serum and donor's cells side of the cross-match for type "O" blood would be the only significant combination. With the addition of A and B group specific substances the necessity for cross-matching will be diminished, and especially so in the case of severe hemorrhagic emergency, where time is so valuable, this type "O" blood may be used. It should be stressed here, however, that no hospital or laboratory should ever consider cross-matching of blood as totally unnecessary, for the human error is ever present and must be carefully guarded against, and likewise at such a time the test for the Rh factor may also be carried out.

TABLE 4

Blood type of recipient	Reported transfusions	Reported reactions	Reaction rate
			<i>Percent</i>
O.....	2,851	109	3.8
A.....	2,056	119	5.8
B.....	549	37	6.7
AB.....	163	13	8.0

TABLE 5

Diagnosis	Reported transfusions	Reactions	Reaction rate
			<i>Percent</i>
Shrapnel wounds.....	250	5	2.0
Amputations.....	419	10	2.4
Fragment wounds.....	663	18	2.7
Burns.....	136	5	3.6
Gunshot wounds.....	1,385	52	3.7
Simple fractures.....	248	11	4.4
Compound fractures.....	368	20	5.4
Hookworm anemia.....	159	11	7.0

REACTION RATES IN VARIOUS INJURIES AND DISEASES

Table 5 reveals factors which have long been considered as contributory to reactions, but generally data have been lacking in the size of the series to justify such conclusions; namely, that with more extensive and serious traumatic injuries, reactions are more prone to occur, and likewise with the severe anemias the same holds true. All the hookworm anemias treated by blood transfusion were under 3.0 million red blood cells, many were under 2.0 million, and a few under the count of 1.0 million red blood cells.

THE RH FACTOR AND ITS EFFECT ON REACTION RATES

It was well appreciated that many injured and sick recipients would be Rh negative and particularly where multiple transfusions were concerned, would receive type Rh positive blood with resulting degrees of sensitization. It is to be remembered, however, that during the war the situation was one of extreme emergency, both at the col-

lecting centers in the United States where the Rh testing sera was not available in quantity, and also because the extra time consumed with such tests would have seriously hampered the volumes of whole blood needed. Likewise the recipients were practically all males who, even though sensitization was actually occurring, would require in most cases, weeks or more of time prior to attaining a high enough titer where serious reactions might occur. Erythroblastosis of course was never a factor. In other words it was a question of outright saving of lives by immediate replacement of blood lost from hemorrhage. Now, months after treatment, however, it should be stressed that particularly those recipient patients who received multiple transfusions should in the advent of future transfusions, be most carefully checked for the Rh factor reactions. Some recent tests made on recipients of multiple transfusions have shown that sensitization has occurred to some degree in a few patients.

ALLERGIC REACTIONS

In a separate group of 381 reactions out of 12,003 reported transfusions, there were 156 reactions or 41 percent of this series were reported on the cards as being allergic in type. Reports read, "urticaria," "hives," and "allergic type."

Since this series is so large it is evident that about half of all reactions in this series are due to an allergic type of response. This is quite an important factor since in the care of seriously ill patients one wishes to minimize the chance of reaction. To safeguard them against allergic type reaction the following should be done: (1) A complete allergy history should be taken from the patient and if possible the donor; (2) fasting donors should be used; and (3) an intradermal skin test may be employed by injecting 0.1 cc. of the fasting donor's serum in the recipient.

As one pays more attention to this type of reaction he certainly will lower the reactions due to this rather elusive agent.

REACTION RATES IN DIFFERENT MEDICAL ACTIVITIES

Table 6 illustrates the varied reaction rates in different hospital facilities using large quantities of blood, and it is obvious that there is considerable fluctuation here. This is definitely due to the degree with which the individual medical officer views a reaction. Some would even classify a reported, "chilly sensation," not accompanied or followed by a rise in temperature, as a reaction. Interpretation of the reactions was discussed many times in all Pacific areas to stress uniformity in reporting reactions, but in the final analysis all of the individual report cards were counted, if a reaction were recorded as having occurred.

Table 6 reveals a number of hospital activities picked at random to show the varying reaction rates.

TABLE 6

Activity	Reported transfusions	Reported reactions	Reactions, percent
44th General Hospital.....	203	14	6.9
118th General Hospital.....	912	23	2.5
126th General Hospital.....	608	4	.6
133d General Hospital.....	222	0	0
148th General Hospital.....	3,093	102	3.3
204th General Hospital.....	1,040	35	3.3
117th Station Hospital.....	138	4	2.8
360th Station Hospital.....	598	16	2.7
Fleet Hospital No. 111.....	358	17	4.7
Fleet Hospital No. 115.....	175	11	6.0
Base Hospital No. 18.....	616	5	.8
U. S. S. <i>Solace</i>	1,097	21	2.0

REACTIONS IN BLOOD OVER 21 DAYS OF AGE

The native Chamorros on Guam have been among the most loyal people to the United States since 1898, but they were all in a most pitiable state at the time of the arrival of United States forces after the invasion of Guam in July 1945. Malnutrition, severe hookworm infestation, widespread tuberculosis in young and old, and the dysenteries, both amebic and bacillary, had taken, and were taking, a terrible toll of life; the maternal mortality likewise was extremely high due to pre- and post-partum hemorrhage, and a blood count as high as 3 million red cells was most unusual among the hospital admissions of all cases. It was not infrequent to see, particularly among infants, counts as low as 750,000 red cells and more often approximately 1,000,000 red blood cells.

The Civil Affairs Hospital then approached the blood distribution center on Guam and asked if it could spare any blood for the maintenance and function of their hospital, for iron and liver in all forms along with plasma and albumin had no effect in combatting or correcting the anemias. The blood distribution center could spare but little blood due to the needs of the casualties, but bloods over 21 days of age were made available rather than discarded. The success of this older blood was amazing, and even moderately hemolyzed blood, up to a visual classification of 2 plus to 3 plus, gave no reaction whatsoever. The results were most gratifying, for the response to recovery and without reaction, was immediate even with blood up to 40 days of age. The facts which were learned from this cooperative effort thus often enabled one to feel perfectly safe, during extremely heavy demands and casualties, to issue blood up to 28 days of age for use. If the 21-day dating period had been strictly adhered to, several thousands

of pints of blood might have been lost due to the fact that the expiration date had been exceeded.

Thus, due to an emergency situation, a much greater number of patients benefited from the extra available whole blood. Not only was better medical care given to the Guamanians, but also once restored to health some 20,000 extra hands were made available to assist the armed forces in a more rapid conclusion of the war.

SUMMARY

1. The preservation, refrigeration, and distribution of human whole blood from the United States into the tropical areas and combat zones was one of the major advances of modern medicine in World War II.

2. In preparation for war, and during the early phases of combat, human dried plasma and albumin were made available to the United States forces in adequate amounts, but it was not long before the need for large amounts of whole blood became evident in both theaters of the war.

3. The first large shipments of whole blood from the United States donor centers started in August 1944 for the European Theater and in November 1944 for the Pacific Theater; and the period covered by this report extended from 19 November 1944 to 21 September 1945.

4. The problems of distance, tropical conditions, preserving solution, standard equipment, and practical studies on transported blood had to be solved prior to undertaking the Pacific distribution. Distances were overcome by granting all whole blood shipments a No. 1 air priority for all transportation. The refrigeration was maintained through the medium of a 5.9 cubic foot refrigerated box with water ice, and containing 16 pints of whole blood which would be maintained at a temperature from 8° to 10° C. for as long as 50 hours. A preservative anticoagulant solution known as the acid-citrate-dextrose or (Loutit-Mollison solution) enabled blood to be safely stored and utilized up to 21 days from the date of bleeding and even longer in the case of emergencies. Standard donor and recipient equipment was set up with the blood bottle being a vacuum type 600 m. bottle containing 480 cc. of blood and 120 cc. of anticoagulant solution. Finally, studies on transported blood of ages from 4 to 31 days gave early assurance of the safety and practicability of this projected distribution and use.

5. The procurement for the blood collection program was made the responsibility of the American Red Cross with bleeding and processing being placed under the technical supervision of the Army and Navy. The program for the European Theater of Operation was under Army control and that of the Pacific Theater by the Navy.

New west coast centers were opened to meet the Pacific demands but following the cessation of hostilities in Europe the east coast also contributed to the Pacific Theater.

6. In the operation of the program, all the blood was flown by the Naval Air Transport Service from Oakland, Calif., to Honolulu. There it was re-iced and then flown on to Guam where the U. S. Naval Whole Blood Distribution Center No. 1 stored all blood in large refrigerators for a minimum of 12 hours, and visually examined all bottles for hemolysis, contamination and clots, discarding all unsuitable units. Visual inspection proved entirely satisfactory for the entire program.

7. Statistical data revealed 177,784 pints of whole blood were received at Guam from the United States, and a total of 171,564 pints were reshipped, accounting for a 3.4 percent over-all loss at the distribution center at Guam. The total weight of all shipments to Guam was 966,700 pounds or 483.35 tons, and required a total of 65,557 cubic feet of plane space for the shipments.

8. Distribution to various areas showed that the Philippine Island campaigns required 93,086 pints, Okinawa 44,802 pints, Iowa Jima 18,068, fleet units 4,508 and all hospital ships 18,068 pints. Table 1 illustrates the individual shipments and allows for a more vivid impression as to the pressure of casualties in the progressive campaigns.

9. Reaction reports were gathered on a small postal card type of report form. A total of 21,296 reports were returned and of these there were 676 reactions with a resulting reaction rate of 3.1 percent.

10. In types other than "O," the reaction rates were above those of the type O recipients, thus tending weight to the desirability of adding type A and B groups specific substance in order to neutralize the iso-agglutinins.

11. The reaction rates were graded as to various types of the injury and the rates were higher as the degree of tissue injury increased.

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EMOTION, THE ETIOLOGIC RELATION TO ILLNESS ¹

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Etiology in psychiatry is indeed a large subject to attempt to cover in a relatively short space; the same applies to psychosomatic medicine. In reality, psychiatry and psychosomatic medicine are one and the same. Therefore, the subject has here been largely narrowed down by limiting the remarks to emotions and their dynamic relationship to the etiology of illnesses, physical and mental.

Emotions are generally recognized for the all-important part they play in everyday life, but seldom are they thought of by the average person as one of the most important factors bringing about varying degrees of noneffectiveness and inefficiency in our everyday lives. Illness, in the minds of most people, means physical illness, never recognizing that probably one-half of all patients of all doctors have only functional or nonorganic complaints.

Until about three score years ago, mental illness was thoroughly confused, identified, and entangled in religion, mysticism, and superstition. The mentally afflicted were grossly mishandled, from that of incarceration and slavery to that of veneration and sanctification. Earlier scientific work in this field was largely limited to a study and description of the mental wrecks.

From about 1890, or the beginning of the present century, the scope of interest in the field of psychiatry has brought about major changes. Psychiatry today is no longer interested merely in the mental wrecks, the end-products, and incarceration, but in the personality defects, the maladjustments, and the actual sick. The scientific emphasis has shifted from an interest in "what it is" to "why it is," from descriptions of static end states to dynamics of changing states, from frank and advanced psychoses to early and minor deviates in behavior, from State mental institutions to community clinics, and from custody and apathy to active efforts in treatment and prevention. The point of view and scope of psychiatry is now directed to the understanding of

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all types of behavior, good and bad, normal and abnormal, individual and group. This is why the understanding of personality and its development is so important in psychiatry. Behavior is the manifestation of personality. Through observing the behavior of an individual his personality becomes known. His inner thoughts and feelings are revealed through his emotional display.

Many physicians, actively engaged in the practice of medicine, maintain certain reservations as to the value of psychiatry and its mind-body concept. With the attitude in which most medical students have been taught, especially in earlier days, the reluctance on the part of a certain number of physicians to accept the subject of psychiatry is readily understood. Their training was directed toward finding a definite organic cause for the problem with which they are confronted. This led to a prejudice against abstractions and theories which they feel are allied with such subjects as psychiatry and psychology. After all, there is considerable scientific and professional satisfaction in being able to see, touch, or hear concrete and demonstrable causes for illness, such as to see certain bacteria under a microscope, to note on a clinical thermometer a temperature of 105° F. in a patient who has suddenly become delirious, to uncover an area of pulmonary consolidation in an acutely ill patient, or to find a basal metabolic rate of plus 50 in a labile emotional state. Satisfying as it is to see and touch etiology, it is nevertheless true that those "causes" which are psychic or emotional in their impact against the human personality are equally as dynamic and motivating in bringing about varying degrees of physical illness as are the organic causes.

Many physicians consider the methods of psychiatry as being mysterious, abstruse, and belonging to a special group initiated in such teachings. The diagnosis and treatment of illness on the basis of the patient's behavior in relation to his environment seem to many physicians an intangible way of making a medical diagnosis. This type of practice was not unfamiliar to the old-time family doctor, with whom the psychiatrist has so much in common. However, any implication of psychological or emotional factors as causing an illness is often interpreted by the present-day physician, and laity as well, as a stigmatization of that individual. What appears to be so frequently lacking in the general practice of medicine is the basic awareness that emotional and social factors are as provocative of illness as are the bacterial and traumatic factors. Since time immemorial, man, when overtaken by sorrow, grief, or disappointment, sought consolation from his fellow man, the same as he had sought advice for the many complexities of life, illness and injuries. The old family physician had an excellent concept of the fact that there was close relationship between an individual's emotional life and his health or illness. This

concept is now called psychosomatic medicine—a new term for an approach to medicine as old as the art of healing itself. With the increase of specialization in medicine, this concept has often been lost sight of.

These same practitioners of medicine, quite wary toward the principles of psychiatry, do not stop to actually realize that the greater part of their job of maintaining the health and working efficiency of the people in their respective communities is inextricably involved with personal, emotional, and social difficulties—those conditions which cannot be palpated, x-rayed, or bacteriologically tested, but as a cause of noneffectiveness, are nonetheless just as real as fractures, fever, or ulcers. They fail to recognize that what they are actually doing is nothing more than psychiatry, that of dealing with the emotional factors in the causation of illness.

Many doctors erroneously believe that such mental conditions as manic-depressive psychoses, schizophrenia, mental deteriorations, or those advanced mental disorders common to institutional care, comprise the major portion of psychiatry. For most of the laity, mental ill-health is conceived as existing and referring only to the crazy, the insane. In reality, most of the patients with whom the psychiatrist is confronted may readily be compared with the common colds of general medicine. These individuals are capable of, and do carry on in their work, but because of their mental conflicts (giving rise to worry, anxiety, tension, and the like), they have varying degrees of incapacitation and inefficiency, as may also result from the common cold. Every individual shows recurring minor attacks of mental ill-health just as he does physical ill-health. The physician must recognize the fact that anyone may become emotionally disturbed, which in turn affects behavior as well as affects human relations. Therefore, to maintain good human relationship in any home or organization, as well as to maintain health, the emotional disturbances must be overcome as early as possible.

The progressive practitioner of medicine today, regardless of his specialty, cannot neglect psychiatry. He is arriving more and more at this conviction, and that to increase his efficiency in his respective field, it is necessary that he expand his knowledge of psychiatry in general. In his practice of medicine, he encounters few medical or surgical problems which do not have a psychosomatic component. The functions of the body and mind cannot be divorced from one another since one is constantly exerting influence upon the other. This integrated behavior of the human body is of major importance in all phases of medicine.

The emotionally disturbed person who is in a pre-psychiatric indeterminate state, frequently tries to worry through his disturbance,

or tell his friends about his troubles, or "blow his top," but sooner or later he usually comes to the attention of the family doctor. It is of the utmost importance that the doctor early recognize these conditions in order that he may immediately and wisely determine the treatment, that treatment so frequently and successfully accomplished through simple "emotional first aid." The future career and health of the individual often hang on the wisdom of the doctor at this point.

It is certainly not the idea, nor here advocated that all physicians should be psychiatrists. It is wise, however, that they be at all times psychologically minded and recognize and appreciate the integrated behavior of mind and body; to remember that health and illness are inextricably involved with personal, emotional, and social conditions. Psychosomatic is a term merely used to indicate that emotions and mental activity of certain types play a dominant role in the pathogenesis. It would be quite helpful for many physicians to cut through the abstract terminology and recognize that in its essence, psychiatry is the medical application of human understanding derived from basic truths which are almost always simple, but never obvious. The more technical aspect of the cases with which they come into contact may be rightfully made the concern of the psychiatrist.

In mental activity, a large portion of the mind is "unconscious." The acceptance of the dynamic concept of the "unconscious mind" enables the student of psychiatry and psychosomatics to logically proceed along a study with understanding which otherwise would be dimmed and indistinct. It is imperative that he recognize that this portion of the mind does exist and that it greatly influences our daily behavior. There are many events in all our lives that have been forgotten—that is, the subject cannot voluntarily recall them. However, these events still influence actions.

The autonomic nervous system can definitely be influenced in hypnosis, but not in the waking state—as suggesting the individual is very hot or very cold. Such conditions as blindness and deafness seen in hypnosis are of the same functional type encountered in a mental illness as hysteria; the material arising in the unconscious mind through dissociation of consciousness.

The term "behavior," used so frequently hitherto in reference to a person, would naturally call forth the term "normal," a term which is subjected to much misconception by the average man. In situations as testifying before courts of law and justice, not infrequently the psychiatrist is asked what comprises "normalcy," and why he uses the term "within the realms of normal." In its application to mental activities as thinking and feeling, the term "normalcy" includes a wide range of actions, reactions, and attitudes, depending on the dynamic relationship of the individual and his environment.

An attitude or action may be perfectly normal for a certain person in a particular environment that would be distinctly abnormal for another person, or the same person in a different environment. For example, it would be completely normal for an ordained minister to preach the Word of God to a group of individuals from the pulpit of his church; but for an individual generally known to be an atheist to suddenly, and without apparent cause, mount the rostrum and begin a similar type of expounding, could only be considered abnormal. Again, if the ordained minister were to transfer his activities from his pulpit to a soap box in the middle of the busiest street intersection in the city, it could then only be considered abnormal. From the standpoint of mental health, "normalcy" exists only when the efficiency, the physical and emotional well-being, the behavior, or the individual's mental activity remains within the socially accepted limits of the situation under consideration. These social limits have been created in the various communities by the individuals of that environment. They then sit in judgment on those individuals deviating from them.

It is to be remembered that man is primarily an animal, masquerading behind a cloak of civilization, still possessing and attempting to deal with his primitive instincts. These instincts, as well as his personal desires and ideas, are constantly being checked and subdued by environmental, educational, and social influences. These two opposing forces give rise to an ever-present source of mental conflict. If the conflict is not satisfactorily compromised or resolved, the way is paved to a faulty response to the conflict, and a mental illness results.

Every person reacts emotionally in his own particular fashion to the environmental demands, whether these demands include accidents or infections, laws or enforced associations, fishing trips or garden clubs, bad weather or bad bosses. The significant fact is that everyone reacts, that everyone does develop body symptoms if the emotional stimulus is sufficiently strong; whether the stimulus is from financial reverses, intolerable marriage, lover's wrath, or an automobile accident. Ordinarily, the symptoms are of short duration, subsiding with the removal of the stimulus. Every individual has his tolerance to emotional stress and strain and, if it is surpassed, may bring about the breaking point which sets into motion the symptoms of a mental illness. If adjustment to the environmental demands is faulty, the individual takes recourse to anxiety, headaches, nausea and vomiting, amblyopia, or obsessions. Individuals suffering from psychosomatic ailments do not always show manifest symptoms of emotional imbalance; therefore, the psychic factors which are underlying or complicating their condition often remain undetected, and this fact may delay or prevent recovery.

Emotions play a dynamic part in our everyday life. As so ably put, "The emotions are literally the heart of the mind." We are fundamentally living by virtue of our emotions. It is through emotions that we are able to tell how our fellow man feels. We hear individuals speak of "taking the load off the chest" by expressing pent-up thoughts and of "breathing easier" after a dangerous and anxious period has passed. We all know that the emotions produce acute physical reactions. The physical acts of trembling, palpitation, and increased sweating accompany fear; blushing is a response to the emotion of embarrassment; disgust may lead to nausea; uncovering a roach in soup about to be eaten may bring about retching and occasionally vomiting—all physical conditions arising from increased emotional tone. If the obvious emotional stimulus were not present, we would call that same physical expression an illness.

To go back to some of the more basic principles of psychology, we may recall that the automatic nature of emotions is well known; the more common normal ones being those of sadness, elation, fear, and their variants of joy, happiness, gladness, sorrow, and anxiety. The simple or major emotions are usually referred to as fear, anger, and love. The many other emotions can all be shown to be modifications of one or a complex of two or more of these three major ones. Attack, flight, facial expressions, and other body movements cause the patterns which differentiate the emotions. Pathological states show exaggerations or mixtures of these normal emotions (moods), or apparent complete absence of emotions (apathy). The chief criteria of abnormality are depth, duration, and setting of the emotions.

It has been said, "Industry is run for profit, and that all may profit," but it is quite obvious that an industry cannot permanently profit unless it is handled by happy, healthy, efficient personnel. One thing that is being learned more and more in this psychosomatic age is that you cannot separate the individual on the job from the individual at home. An emotionally adjusted worker is far more efficient than one who is maladjusted. It is a well-recognized fact that a very high percentage of occupational, traffic, and other various type accidents are due to personal factors such as carelessness, inattention, apathy, worry, and fear—all of which are emotionally based. The emotional states as anxiety, irritability, resentment, grief, and others, retard thought processes and cause one to make mistakes and errors in judgment which would not be made if the emotional state had not existed. Emotional unrest and instability create a situation which is filled with many possibilities.

The advent of psychosomatic medicine in general practice has brought forth an attitude of an open door for all patients, regardless of the complaint. This compels all doctors to be aware of the large

number of people who are sick and yet do not have any definite bodily disease to account for their illness. It brings forth the realization that the emotional factors in a person's life may have a definite effect in promoting a physical illness just as other emotional factors do in maintaining contentment and happiness in their daily activities.

It has long been the contention of psychiatrists that emotions do lead to incapacitating and even fatal physical illnesses as do bacteria and trauma. Even though the medical profession as a whole has never been too friendly toward psychiatry, most progressive doctors today agree with this contention. It is within this area of agreement that the practice of psychosomatic medicine largely has developed and sky-rocketed during the past few years. During this time, the medical profession has obtained a much better recognition of psychosomatic conditions. It is a conservative estimate that 40 percent of all military service disability cases are of psychosomatic origin. It would appear that while infections have declined, the relative proportion of psychosomatic illnesses has increased. This could be partly due to the notable triumphs of medicine over bacterial infection.

Until recently, most physicians believed that only gastro-intestinal conditions, as peptic ulcers and colitis, could be considered as actually psychosomatic. However, the emotions are now regarded as the primary cause in many cases of bronchial asthma, hay fever, hypertension, heart disorders, the common cold, various dermatological conditions as hives, warts, and allergic reactions, as well as many other physical illnesses. If the emotions are not the primary cause, they may readily be a precipitating or aggravating factor.

Having decided the illness of an individual is psychosomatic, the next step is to locate the source of emotional difficulty. Sometimes it is apparent in the life situation of the patient—as intolerable marriage, hopeless financial situation, enforced regimentation of the military services, and the like. However, more frequently the case is not so simple; the emotional disturbance may be buried in the unconscious, in which event the patient will not know anything about it except as it produces a chronic feeling of uneasiness or anxiety.

In psychiatry the main interest is directed toward why an individual behaves as he does, and how the response can be varied. What are the explanations of behavior—normal and abnormal? How do variations come about? Why should some people have the normal emotional reactions prolonged until they become a physical illness? Why do emotions sometimes express themselves in physical symptoms such as palpitations or cardiac discomforts, diarrhea, or chronic dyspepsia; or other times in the psychological symptoms of phobias or obsessions; or still other times in antisocial behavior? For the

answers to these questions there must be an understanding of the anatomy and the physiology of the general structure of the personality.

The psychosomatic patients' difficulties are the same as those of the normal person, the only difference being that their difficulties are much greater than those which all normal persons have. The criteria for the diagnosis of psychosomatic conditions are the finding of satisfactory psychological causes and the absence of any primary physiochemical cause. Diagnosis is never made solely on the basis of exclusion.

In conclusion, the general practitioner's job has always been, and will continue to be, prophylactic, therapeutic, and morale building, with relation to the individuals of his community. He successfully accomplishes this aim by maintaining a philosophy of medicine which makes for a full knowledge of the sick man, a person whose illness may have a social implication. Even though the general practitioner appears to perform his job intuitively, he actually possesses considerable knowledge of psychiatry and the psychosomatic approach, as well as the basic principles of psychotherapy.



STUDIES ON THE COMPARATIVE NUTRITIVE VALUE OF FATS

Authors' summary.—Residual fat is removed from skimmed milk powder only to the extent of 12 to 31% by four successive 8-hour extractions with diethyl ether and to 21 to 48% when extraction is continued for four additional 8-hour periods when the mixture is constantly agitated. Continuous extraction for 72 hours with diethyl ether on a Soxhlet apparatus removes about 20% of the residual lipids while extraction with ethyl alcohol resulted in a lowering of 35% of the original content. The most effective extraction was made by simultaneous extraction with alcohol and ether.

No differences in rate of growth or in the total ultimate gain in weight over a 12-week period was observed when weaning male or female rats were fed extracted skimmed milk powder mixed with fat, irrespective of whether a butter or a margarine or corn, cottonseed, peanut or soybean oil was the fat used.—DEUEL, H. J., JR., HENDRICK, C. MOVITT, E., CROCKETT, M. E., SMYTH, I. M., and WINZLER, R. J.: Studies on the comparative nutritive value of fats; the failure of ether extraction to lower the nutritive value of skimmed milk powder in diets containing various vegetable fats. *J. Nutrition* 31: 747-753, June 1946.

NAVAL MEDICAL SPECIALISTS UNITS

A Proposed Plan for Their Reorganization and Continuation

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FOREWORD¹

The Bureau of Medicine and Surgery has initiated the reorganization of Medical Specialists Units. A number of suggestions and plans have been received from Reserve Medical Officers. It is the intention to utilize many of these suggestions in the reorganization of the Medical Specialists Units. Commodore Kern's article which follows contains much interesting comment on the subject.

The classified components of the Naval Reserve are:

(a) *The Organized Reserve*—a force of trained officers and men organized with the definite purpose of availability for immediate mobilization. This group, while on a voluntary basis, is required to carry out a definite training program.

(b) *The Volunteer Reserve*—this component is a much larger organization on a purely voluntary basis, but subject to immediate mobilization in time of national emergency. These Reserves are not subject to the heavier periods of training prescribed for the Organized Reserve. Volunteer Reserves, however, may request periods of active duty training, including an annual formal 2-week period.

The Medical Specialists Units will be included in the Volunteer Reserve component.



INTRODUCTION

The high standard of professional care which obtained in the United States naval medical service during the recent war was materially upheld by the hundreds of highly skilled doctors who comprised the many Naval Medical Specialists Units. Carefully selected in times of peace, the Unit staffs were representative of the best talent in the civil-

¹ Foreword by M. D. Willcutts, Rear Admiral (MC) U. S. N.

ian medical profession. Moreover, the Units had been organized long enough before the war to make possible effective long-range planning for any emergency. When the emergency came, from the beginning the Navy had the services of a larger percentage of well-trained specialists among its Reserves than it did in World War I.

Before the end of the war all the Units had been broken up and their members dispersed throughout the naval service. The long duration of the conflict, the rapid expansion of the service and the consequent need for experienced medical officers in many new ships and stations made that necessary. Nevertheless, and for reasons later to be mentioned, many former Unit members were not happy about the procedure. Today, they and their friends are not enthusiastic about the reorganization of Units.

But the Navy needs Medical Specialists Units, and needs them now. They are of prime importance in the structure of an effective Naval Reserve, both as operational units that can function smoothly early in case of war, as well as supplements to the Regular Establishment. Doctors are never a dime a dozen, especially in wartime, and accredited specialists are always a rare commodity. Specialists Units are the most prolific source of such trained personnel. Therefore a plan, acceptable to the Bureau of Medicine and Surgery and attractive to the right type of civilian physician, is urgently needed. It is hoped that the plan here to be proposed will meet these specifications. •

Perhaps the writer should state his qualifications to discuss the matter. For 30 years he has been intensely interested in the naval medical service. He has served at sea on hospital ships in two wars: in the first as a member of the Naval Medical Corps and on duty with a Unit of Medical Reserve officers; in the second as organizer and member of a Naval Medical Specialists Unit. He helped organize seven such Units in addition to his own. During 4 years of active duty in the recent war, 2 of them traveling in the Pacific either on a hospital ship or as consultant in medicine on the staff of the commander of the South Pacific area, he had the opportunity to see many such Units in action, to know their strengths and their weaknesses, and to learn the viewpoints of several hundred members of such Units. Convinced of the value of such Units, he urged their formation in the decade that followed World War I, and since 1934 has taken an active part in such formation. His views, therefore, are based not only on long interest but broad experience.

HISTORICAL

Present problems and needs will be better understood if viewed in the light of what has happened in the past. In the First World War the Army organized Hospital Units from the staffs of a number of the

hospitals and medical schools of the country. They proved highly successful in meeting the need for qualified personnel to man service hospitals. The Navy followed this lead, but at a rather late date, and to a very limited extent. Since the Naval Establishment had to be expanded to a far less degree than the Army, there was comparatively less need for Units of Medical Specialists. Moreover, by the time the Navy undertook the recruiting of Units, the field had been pretty well picked over. The naval Units then were small, consisting of five members: an internist, a surgeon, an eye-ear-nose and throat specialist, a roentgenologist, and a pathologist. After the war they were disbanded.

In 1934 Admiral Perceval S. Rossiter (MC) U. S. N., then Surgeon General, had the wisdom and foresight to introduce a program under which a number of Naval Medical Specialists Units were organized in the several naval districts and by interested and qualified officers of the Naval Reserve, usually in connection with a medical school or an important civilian hospital. They consisted of eight medical officers and one dental officer and covered the following specialties: surgery, ophthal-oto-laryngology, urology, psychiatry, internal medicine, roentgenology, and orthopedic surgery.

Because of the fact that a member of a Unit might unexpectedly be disqualified by physical disability, it seemed wise to enroll an alternate for each principal member. Alternates were required to be qualified specialists in their respective fields. They were given no assurance that in case of national emergency they would serve with the Unit to which they belonged. In consequence, few Units ever acquired a full quota of alternates. Later still, it was decided to have each Unit enroll six nurses (they were originally enrolled in the American Red Cross, later in the Navy Nurse Corps Reserve) for covering certain functions, such as operating room work, anesthesia, and others.

The wisdom of this policy was amply proved, for at the outbreak of the war the Navy found itself well supplied with medical specialists of very superior qualifications.

As the threat of war suddenly grew, the work of organizing Naval Medical Specialists Units was greatly expanded. It soon became clear that a new policy was being followed: a policy whose main purpose was the enrollment of as many qualified specialists as possible. Certainly, it was obvious that many more Units were being formed than there would be place for, even in a huge wartime establishment. Yet prospective members were given to believe that they would serve *as Units* on "hospital ships, station ships, base and naval hospitals as staff thereof." Nor did they read the rest of the sentence in the Bureau of Personnel Manual: "or to augment the Regular Navy Medical Corps Staff." When those words were first written, they were still intended

to mean that Units as Units would augment the regular staff of a hospital ship or a hospital ashore. What actually happened in many instances was wholly different.

When war began, there was no mobilization of Units as such: their members as individuals were ordered to active duty.

Many Units never served together but were broken up at once and their members assigned where needed. Others had a brief separate existence, until they too were scattered. A few continued to function as Units for nearly 2 years before they disintegrated. The writer's own Unit was perhaps the most fortunate, in that 12 medical officers, 1 dental officer, and 4 nurses served as a Unit on a hospital ship (*U. S. S. Solace*), the individual tours of duty ranging from 1 year for the nurses up to nearly 2 years for some of the medical officers.

It must be emphasized that such a redistribution of Unit personnel was ultimately necessary, because there was need for these experienced medical officers in other places. For example, of the 12 doctors and 1 dentist of the Unit on the *Solace*, 11 eventually became chiefs of service in the larger activities to which they were transferred. Other units had comparable records. Moreover, in many such instances, the transfer of Unit personnel meant a return to a States-side hospital after a tour of overseas service. But even in such Units, the members have wondered, could they not have been sent to the same station, instead of being scattered to the four winds. And in support of that view they point to the fact that the Army, which underwent an expansion proportionally several times greater than the Navy, kept its major Medical Units, that had been recruited as such, intact.

This question of the reaction of the members of Naval Medical Specialists Units to what happened to their Units is decidedly pertinent to the subject, because they are being appealed to, in the first instance, to help in the reconstitution of the Units. Also the chief sources for new material for Units are the same hospitals and medical schools to which former Unit members belong.

Before considering ways and means to reconstitute the Units, one should first take stock of the *defects and short comings* which the Units obviously had.

Chief among these was a lack of provision for the changes which even a few years make in the status of Unit members. A man who in 1935 was excellent Unit material by reason of age and training may have reached a higher standing in his school or hospital than by 1942 made him indispensable to that institution in wartime. Even promotion in the service eventually made Units top-heavy with rank. Obviously, the period during which a specialist is suitable Unit material is strictly limited.

Nor did alternate members solve the problem. There were no specifications as to the comparative ages of alternates and their principals: To be sure, it was suggested that they be younger than the principals, but no actual differential was set. The writer nevertheless selected as alternates only those who were at least 10 years younger than their chiefs, and so was able to fill the gaps that time wrought in the ranks of principals. But the younger the alternate age, the harder is it to find qualified specialists, and so in most Units there were too few alternates or else they were too old.

A second defect that became obvious when many Units were called to active duty was a woeful lack of knowledge on the part of their members of matters naval. This ignorance was accentuated by the high initial rank to which age and experience entitled men without any previous experience in Army or Navy. The Navy had afforded no opportunities for active duty at sea to Unit members, even though they offered to undergo such training at their own expense. Nor did a few weeks of indoctrination at a naval hospital after the outbreak of the war dispel the ignorance. There resulted many embarrassing situations in which Unit members were largely at fault, but which served only to accentuate a tendency to clannishness on their part. (In one case, a Unit attached to a hospital tried to establish its own ward room mess.)

A third defect was of a professional nature: the specialties represented in a Unit. It is an anachronistic absurdity that the Navy expects to find in civilian practice those who are expert both in ophthalmology and otolaryngology. More and more the first yardstick to be applied to a would-be specialist is certification by an American Board. A glance at the third edition (1947) of the Directory of American Specialists will show that practically no one has such double qualification. For instance, no one in Philadelphia is certified in both fields.

Equally serious was the lack of a dermatologist in the Units. Any one who had duty in the Tropics knows what that meant. The writer tried hard to have attached to his Unit a certified man who had held professorial rank in a medical school. The request was denied and the man served most of the time on an attack transport.

There was a lack of personnel skilled along technical lines. At least one Hospital Corps officer of pharmacist's rank and trained in laboratory work would have been found most useful.

The excellent work done by the Unit nurses in the single instance in which to the writer's knowledge, a naval Unit at sea included its nurses enrolled from the same civilian institution would emphasize the deficiency of other Units in this regard.

SUGGESTIONS

In the light of these facts the following suggestions are offered for the reorganization and continuation of Naval Medical Specialists Units. The adoption in principle of the plan by the Bureau of Medicine and Surgery would go far toward insuring its successful operation because it would gain the enthusiastic support of those whose supports is most needed: the former members of Units.

1. *The purpose of Naval Medical Specialists Units* is not merely the assembling of a group of specialists capable of heading major services in any naval hospital—that could be done by drawing names out of a hat. In addition to their professional qualifications, they should be men who have been trained and who have worked together in the same civilian hospital over the years. They therefore know each other's capabilities, and so, in case of national emergency, could be sent anywhere and would be sure to click professionally from the start.

2. *Units should therefore be kept intact in wartime.* That is, they should be permitted to serve in the same naval facility: it is immaterial whether this be in a small station that a Unit could completely man, or a larger one in which the Unit would augment the regular staff. This should apply to all members of the Unit, including principals and juniors. Detachment of individual members from Units should occur only as provided for in what follows, or on the individual's own request for transfer.

3. *The Unit itself should be a permanent organization.* But its members should hold their place in the Unit only so long as they possess the qualifications below specified.

4. *The Unit should include the following personnel:* (a) A principal and a junior (not alternate) in each of the following specialties: clinical pathology, dentistry, dermatology, internal medicine, neuropsychiatry, ophthalmology, orthopedics, otolaryngology, roentgenology, surgery, and urology. (In these categories, further differentiation might be made if, for example, in the laboratory the principal were a chemist and the junior a tissue pathologist: when the junior eventually becomes the principal, the new junior would be a chemist). (b) A warrant officer, Hospital Corps, skilled in laboratory technique. (Here again, two members would make possible the selection of one trained in chemistry and the other in bacteriologic and serologic technique.) (c) Seven nurses: one each trained in general operating room technique, special operating room technique, anesthesia; two each for medical and surgical ward duties.

5. *The qualifications of a principal should be:* (a) Certification by the American Board for his specialty. (b) Age at appointment not

less than 37, preferably 40. (c) At age 52, preferably 50, a principal should automatically be separated from the Unit and become available for individual assignment elsewhere. This would insure a constant increment of senior specialists: the least well-supplied category at the outbreak of a war.

6. *The qualifications of a junior should be:* (a) Age at appointment not less than 27, preferably 30. A modification of this requirement could be considered, provided that the junior be not less than 10 or more than 15 years younger than his principal. (b) Certification in his specialty need not be insisted upon at the time of appointment, provided that good evidence of well-advanced training toward certification be presented, and provided further that the candidate has not reached the age of 32. A junior member of a Unit who fails to attain certification by the time he is 32 years old should be dropped and another junior selected. (c) When the junior reaches age 40 or when the principal reaches age 52 (whichever happens first), the principal should be separated from the Unit, the junior advanced to principal, and a new junior selected.

7. *The availability of Unit members for service in case of emergency should be checked annually.* This applies especially to those attached to teaching institutions and who might have become indispensable thereto.

8. *Questions of rank and promotion* naturally arise in this picture, but are eliminated from this discussion to avoid beclouding the issue. It should be pointed out, however, that certification in a specialty is an attribute that commands recognition and preferment in other fields of activity, and one Government agency, the Veterans' Administration, rewards its possessor with a 25 percent increase in pay. The Naval Reserve medical officer who spends his efforts in achieving certification should be given equal consideration in promotion as that given him who puts in his time in connection with a Unit of the Organized Reserve.

9. *Naval Medical Specialists Units*, to pursue the last idea further, *should themselves be considered as part of the Organized Reserve.* They need not be subjected to as detailed a regimen as that prescribed for combatant Units of the Organized Reserve, but there should be some routine activities prescribed; they should not be organizations on paper only. If this be granted, the succeeding paragraphs naturally follow.

10. *Units should hold periodic meetings*, in Regular naval medical facilities or in Naval Reserve armories. Such meetings need not be oftener than quarterly. They should be under the cognizance and direction of the district medical officer and the officer in charge of Reserves in the district. The writer held such meetings of his Unit

quarterly for over 6 years preceding the last war, and the district medical officer usually attended.

11. *Correspondence courses* in naval medical procedures, etc., should be required of all newly appointed Unit members.

12. *Active duty training* should be made available for and required of Unit members as individuals annually, allowing a 2- to 4-year accrual, and should be at sea and/or on a naval station outside the continental United States. The whole Unit should be mobilized at a Regular naval medical activity, preferably a naval hospital, for a 2-week period once every 4 years.

13. *Units should be integrated in war plans.* Members should know their mobilization assignments, both as to place and M + ? date, and perhaps to include alternatives based on certain contingencies. If there be another war, it will be ushered in by surprise attack and consummate confusion. The individual Reservist should therefore know what to do in the emergency and without waiting to be told.

COMMENT

Nothing more need be said about the plan itself; its provisions would appear to be simple and workable. There remains to be emphasized the need for the early adoption of this or some other plan, acceptable and attractive to medical specialists both in and out of the Naval Reserve. The earlier that a plan is adopted the surer and the more promptly is it likely to succeed. The best possible source of Unit material today is the group of qualified medical specialists who are now members of the Naval Reserve. Their available number is bound to decrease and with growing rapidity as months and years go by, because of attrition and loss or change of interest. If they accept the plan now and join up, they will be the best possible agents to recruit and indoctrinate the Unit juniors from the oncoming generation of budding specialists in civilian practice. If they do not find a plan to their liking, if they do not furnish the great majority of Unit principals now, it will again become necessary to recruit these one by one from among civilian doctors, and that will be even slower, more arduous and less effective a task in a period of postwar let-down than it was in the years before the war. Time is indeed the essence of the problem.

That is why it occurred to the writer to choose the medium of the U. S. NAVAL MEDICAL BULLETIN to air his views. The BULLETIN now reaches many thousands of medical officers of the Naval Reserve who have returned to civilian practice but in whose minds the experiences of wartime service are still vivid memories. It is hoped that this article may arouse the interest of some of them to write their views

on the subject, to make constructive criticisms, and to offer their help in this important project.

SUMMARY AND CONCLUSIONS

1. A plan is suggested for the reorganization and continuation of Naval Medical Specialists Units. Its major points are as follows:
2. Units should be considered permanent parts of the Organized Naval Reserve and integrated in naval planning.
3. The Units should be kept intact during war as well as peace.
4. Permanency of the Units could be made feasible by two expedients:
 - (a) Two types of members: a principal and a junior in each specialty who differ in age by about 10 years.
 - (b) An upper age limit beyond which a principal shall be detached from the Unit and made available for other and individual assignment.
5. These suggestions, together with some as to types and numbers of personnel, are based on a review of past experiences with Units, their advantages and their shortcomings.



THE INFLUENCE OF INSULIN ON CAPILLARY PERMEABILITY

Insulin in small doses (hypoglycemic condition) increases the permeability of the capillaries. In large doses (hypoglycemic shock), on the contrary, insulin lowers the permeability. Moreover, in patients who have had gastrointestinal illness, a high capillary permeability may have already been established so that in such cases the supposed effect of insulin is estimated as higher than it really is. The authors will seek by neurohumoral control to explain this reaction. The influence of insulin upon the cell membrane potential is discussed.—BENDA, L. and LOUKOPOULOS, L.: Über den Einfluss des Insulins auf die Capillardurchlässigkeit. *Zeitschr. klin. Med.* 143: 718-726, 1944; *Biol. Abstr.* 20: 873, May 1946.

MEDICAL SPECIALISTS IN NAVAL SERVICE ¹

PAUL TITUS ²

Captain (MC) U. S. N. R.

The prime function of the Medical Department of the Navy and likewise of the Army is to give the best possible medical care to the personnel of these services. That this objective was well met during the recent war is demonstrated by the fact that only about 2 percent of wounded died of their injuries, whereas during World War I the death rate following wounds was approximately 11 percent.

The fact that this paper will refer most often to naval service should not be construed as suggesting that Army activities were not along closely related lines and equally effective but merely that the writer is discussing what he knows best. Indeed the warm cooperation and interchange of ideas and plans between the two services were a most pleasant feature of the writer's own tour of duty with the Navy.

Medical care of naval personnel both in war and in peace embraces all types of disease and injuries, quite aside from battle casualties, and even greater in scope than that seen in civilian life. Epidemiology, dermatology, general surgery, neuropsychiatry, urology, and all phases of internal medicine are some of those that come instantly to mind. Obstetrics, gynecology, and pediatrics are not usually considered as busy specialties within the Navy, but the Medical Corps is obligated by law to take care of dependents of naval personnel. It was estimated that during the war years naval medical officers attended in labor and confinement each year approximately 30,000 wives of naval personnel. For gynecological services we had these same dependents plus the WAVES and others constituting actual female personnel of the Navy. This is a state of affairs not generally realized or appreciated by the public.

The activities of the Medical Department of the Navy, which includes the Medical Corps, the Dental Corps, the Nurse Corps, and

¹ Read before the Fifty-seventh Annual Meeting of the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons, 5 September 1946, and to be published in vol. 57 of the Transactions of the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons.

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the Hospital Corps, were many and varied. The first responsibility of the Medical Department was to staff the ships and distant stations and fields where naval action was going on. Second, the great naval hospitals within continental limits and in some of our possessions had to be and were superbly staffed, specialists being appropriately used wherever this was possible.

The story of the Naval Medical Research Institute at the National Naval Medical Center, and its many achievements alone would fill a fascinating volume. For your interest, a few of these may be cited. A simple, compact device for desalting sea water was developed to be attached, with compact emergency rations, on life rafts for survivors from disastrous sea action. Immersion and exposure suits were devised for protection of those immersed in cold Northern waters where even short, unprotected exposure may be fatal. Cream for protection against flash burns from exploding shells or bombs, ointments for protection against chemical warfare agents, chemical impregnation of clothing, body armor, and methods of protection against biological warfare agents were among the more spectacular of these achievements. Less so were the new methods of treating burns, malaria, and various infections, the prevention of tropical diseases, development of insecticides, and similar items.

Aviation medicine was a specialty in itself. Air transportation of medicines, blood and blood plasma, and air evacuation of casualties were amazingly developed.

Preventive Medicine Division of the Bureau of Medicine and Surgery of the Navy staffed its special epidemiology units with specialists in sanitation and public health and these did notable advance field work against tropical and other epidemic diseases. It was in these that pediatricians were found of especial value because of their previous experience with acute infectious diseases such as measles and scarlet fever which plagued the services.

The work of the Neuropsychiatric Division of the Navy, and likewise of the Army, is well known now to all, but the volume and scope of this work will probably never be appreciated. The Navy pioneered in group psychotherapy in military service.

Plastic surgery is now doing its slow, tedious work of rehabilitation, while the blind and the deaf constitute a special problem. Rehabilitation centers with physical medicine and occupational therapy, and special training for amputees, for the blind, and for the deaf have been created and staffed with expert and devoted workers.

All of the foregoing has been presented in answer to the question as to whether the Navy and the Army actually made an effort to assign medical officers to duties for which they had special training and experience. The answer is, unequivocally, that both did do so.

Having realized that so many special types of service were needed, as have been cited above, you may be sure it was equally well realized that special training and talents should be assigned to these tasks.

Everyone of us has heard of or known some doctor with more or less training in some specialty who went into the Navy or the Army and was assigned to work foreign to his training. Such complaints are what we are much more likely to hear than the story of the man who did have an appropriate assignment for at least part of his military service. Moreover, early in the war the pressure was so great that inappropriate assignments of specialists often were made and some of these may not have been corrected even for the duration. These are what you are most likely to be told about as a defect in the services.

On the other hand, a questionnaire sent late in the first year of the war to Diplomates of the American Board of Obstetrics and Gynecology in service showed that approximately 71 percent in the Navy and 50 percent in the Army were, in their own opinions, already appropriately assigned in this so nonmilitary a specialty. Of the balance many were in closely related specialties such as surgery. Later in the war this distribution was even better.

This was accomplished in the following manner. In the offices of the Surgeons General of both the Navy and the Army there were almost identical files of classification and qualification of all medical officers. These were divided into a classification according to specialties, including that important specialty of general practice, and then were graded into four groups according to training, experience, and other qualifications in the specialties.

In the Navy's professional qualifications file, as it was termed, these data were transferred by the Statistical Division of our Bureau to punch-cards from which IBM "runs" were made in book form giving all possible types of information about various qualifications of medical officers, that were thus instantly available. For example, a request could be made for names of all officers filling sharply specified requirements for a certain special duty as, that he must be unmarried, without dependents, between 35 and 40 years, preferably with previous residence in China, able to speak certain Chinese dialects, with experience in tropical medicine and some surgical experience; rank not less than lieutenant commander, preferably serving in aviation medicine, and now on shore duty. On short notice all such names could be supplied through these amazing sorting machines.

Varied demands might be made. Personnel Division on one occasion asked for information about staffing a 3,000-bed hospital just taken over from the Army. Suitable specialists of suitable gradings

or degrees of experience and responsibility were tabulated and decisions about assignments thus promptly assisted.

The medical officer assigned in command of a large naval hospital then under construction used these files personally in making requests for key staff officers and others, selecting a group that would have done credit as the faculty of any medical school. How many of these were available was another matter, but the staff of that hospital was a keen one.

Diplomates of American Boards were utilized, in their specialties, by the Navy as much as it was possible under the stress of war conditions. Younger officers who had had part of their residency training in a given specialty were also appropriately utilized, to a lesser degree. The Navy invited requests for assignments for special training, and particularly in the case of these already partly trained men whose services could be most useful in the specialty of their choice, many a man was given an assignment for which he could have credit before his American Board.

In this war, therefore, nose and throat men were not doing appendectomies, proctologists were not performing eye operations, and surgeons were not taking care of tuberculosis or pneumonia patients, at least not as a regular thing or for long. Many a woman had better obstetrical care than she could have had at home, although she might scarcely know her doctor's name.

Excellent training in the specialties was given in the various large naval hospitals where accredited intern training had been carried on since 1924. Young officers assigned to these institutions at one time or another were, indeed, fortunate.

Long before the ending of the war and the release of Reserve officers it was realized by many of us that this would mean a great loss of teachers, and that future training would fall upon the officers of the Regular Medical Corps. Early in 1944, the Navy anticipated this and started an active graduate training program to provide replacements of these specialists from the Regular Navy. Many of the naval hospitals were able to obtain approval for residency training by the A. M. A. and a number of the American boards, as well as for graduate training in the surgical specialties by the American College of Surgeons. Vice Admiral Ross T McIntire, the Surgeon General at that time, needed no convincing about the value of what soon came to be called the Graduate Medical Training Program. From the first his support of the project was enthusiastic, and his grasp of the subject surprising even to those of us who were so close to it. Often he anticipated and proposed steps and plans which we had hesitated to suggest. For example, in the matter of libraries for hospitals giving intern and residency-type training, the suggestion was made that

better libraries would be required and that for these hospitals they should be standardized. Our Professional Division was at once directed by him to prepare suitable lists of books and journals, whereupon he issued orders to medical officers in command of naval hospitals regarding the immediate establishment of such libraries and also found ways and means of providing for the cost.

Naval hospital libraries now compare with the best in the country.

With the ending of the war, it was decided by the Surgeon General that the best talent of the Regular Service should be concentrated in nine centers, where the broadest training in the greatest number of specialties could be carried out. Other hospitals with fewer formally approved services are still to be kept well staffed and shall continue to take a large part in the general training program which should grow still larger as more and more young Regulars finish their residency services and qualify for American Board certification.

This training program is capably headed in the Bureau of Medicine and Surgery of the Navy and in addition a small but intensely active Reserve Consultants Advisory Board has been appointed by the Surgeon General to help supervise all phases of the program. Locally, the regular staffs of the naval hospitals are augmented for teaching and consultation purposes by visiting consultants from the Naval Reserve practicing in the vicinity of these hospitals. Each of these consultants, to qualify for appointment must be a Diplomate of the American Board of his specialty. The Army has been developing a somewhat similar plan.

The Navy's general plan for training is an elastic one. Young officers may obtain their entire training for American Board certification in a specialty in one or more naval hospitals, or they may do this by a combination of naval hospital and civilian hospital residency appointments. The teaching staff of each naval hospital will be a combination of qualified and certified medical officers of the Regular Navy and of inactive Reserve officers serving as consultants. There will thus be a valuable overlapping between military and civilian specialty practice and teaching. The Surgeon General again showed his foresight by providing for a certain degree of stabilization of the teaching staffs on active duty, in place of the former flux from constant shifting of personnel. Key men, in particular, are to be "frozen" in their assignments for relatively prolonged periods of time.

To indicate the possibilities, it may be cited that there are already 19 officers of the Regular Navy now on active duty holding certification from the American Board of Radiology who will, obviously, be the key men in the staffing of hospitals where training in radiology is to be conducted. Another example of what is hoped to develop further, is that of one officer of the Regular Navy, now head of the

Family Dependent Service at one of the designated training centers. He saw active service and was wounded on duty with a Marine division, is certified by the American Board of Obstetrics and Gynecology, and while on his present duty has also recently been appointed to the teaching faculty of a nearby and important medical school in obstetrics and gynecology. Thus he represents an overlapping between civilian and military practice of medicine in the specialties, which is precisely what this naval training program is designed to foster.

It should be apparent from such examples as these that any possible old lines of cleavage between military and civilian medical practice have been broken down, as they should be.

If you, in your clinics, will accept a few young officers from the Medical Corps of the Regular Navy for approved residency training you will be doing a worthwhile service for your country. I urge that you give such men earnest consideration if they apply to you. Consider also, if such men are granted long assignments away from their ordinary duties to take up an appointment they may win competitively with you, that this is evidence of the high esteem in which the Navy holds you.

Such action and such programs as this described, and that of the Army which is quite similar, will make the Regulars even more tolerant than they already have been of the inexperienced Reserves if another war should come; it will give the Regulars opportunities for advancement in their special fields that they have had to sacrifice for the sake of serving in the Navy or the Army; it will give civilian medicine a greater chance to profit from the advances of military medicine, and vice versa; and best of all, by creating better standards of practice of medicine in this country whether in time of peace or of war, not only our fighting men but the entire population are certain to benefit.

NOTE.—Rear Admiral Clifford A. Swanson, appointed Surgeon General of the U. S. Navy, succeeding Vice Admiral McIntire, shortly after the presentation of the foregoing paper, has recently reiterated his long interest in the Graduate Medical Training Program by declaring his intention of continuing and extending its scope, and by reappointing the Reserve Consultants Advisory Board in its original membership.

TREATMENT OF ACUTE ACROMIOCLAVICULAR DISLOCATIONS

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and

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Injuries of the acromioclavicular joint are not uncommon, and since the dislocations may become chronic and disabling, a simple and effective method of early treatment, as applied to six patients at the U. S. Naval Hospital, San Diego, Calif., is presented.

Anatomically, this gliding joint consists of an articulation of the antero-medial portion of the acromion process and the distal clavicle.

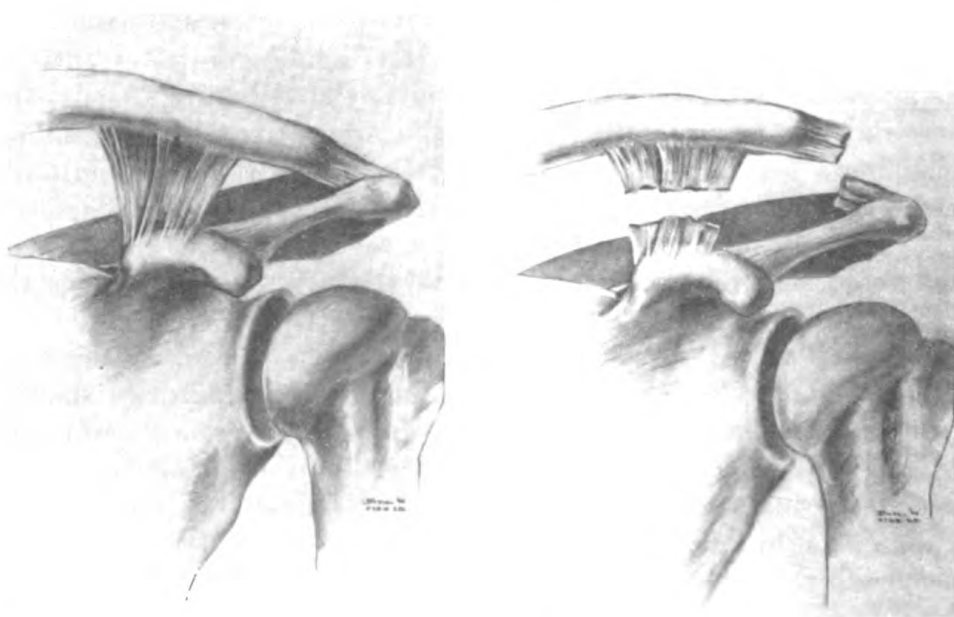


FIGURE 1—(A) Normal acromioclavicular joint. (B) Complete rupture of capsular and coracoclavicular ligaments allowing upward dislocation of the clavicle.

ular tip supported by capsular and two coracoclavicular ligaments. Rupture of these ligaments permits upward displacement of the clavicle, maintained by the sternocleidomastoid and trapezius muscles; the weight of the extremity pulls down on the acromion and further distracts the joint.

Direct trauma to the shoulder, as encountered in football blocking, falls, and tumbling (1), is frequently responsible for the injury. By textbook description (2), a minor injury is limited to tearing of only the articular capsule with a resulting subluxation. Severe trauma, causing severance of the coracoclavicular ligaments, produces a complete dislocation.

The patient usually experiences a variable amount of pain and tenderness confined to the joint surface. Depending upon the degree of dislocation, a spongy, springy feel is elicited by palpating the clavicle, and an asymmetry of shoulder contour is noted. Local swelling and limitation of motion are frequently minimal. X-rays, taken with the patient upright and with a 15-pound weight held in the affected extremity, confirm the diagnosis. Two-thirds of the films of this series, taken without this traction to the extremity, were interpreted by radiologists as normal, yet later films of the same patients, taken with the weight applied, revealed clear, radiographic evidence of dislocations. An elevation of the clavicle a half or more of its width above the superior margin of the acromion was considered diagnostic. Since a normal joint is seen to move radiographically (3) with all positional changes of the shoulder, less importance was attributed to the width of the joint space itself. This normally varies from 2 to 10 millimeters, relative to the degree of scapular rotation.

The principle of any treatment consists of immobilization of the joint and of allowing ligamentous structures to heal, usually maintained by combining downward pressure over the clavicle with an elevation of the acromion. This has been accomplished by conventional strapping (2), by a strap-brace (4), by a combined spica and shoulder strap (5), and by using steel pins (6). Chronic dislocations have courted many types of operative treatments. No originality is claimed for the method to be described; strictly, it should best be classified as a modification of that described by Wolin (7).

Usually, reduction is easily accomplished, a soft crepitus is often felt as the clavicle is depressed, but withdrawal of the operator's hand allows immediate redislocation. The authors have effected continuous downward pressure and reduction by the following:

Over stockinet a plaster girdle is applied about the chest, extending from the nipples to the lower rib margin. By means of heavy wire a belt buckle is incorporated in the midline of the cast anteriorly, and similarly, a web belt, 1½ inches wide and 3 feet long, is secured pos-



FIGURE 2.—Follow-up film of case 1 taken 3 months following injury. Admission film (not pictured) disclosed clearly a dislocated joint.

6 weeks. The patient is instructed to tighten the belt if necessary.

The advantages of this method of treatment are these: within a few days the patient discards the sling and is free to use the extremity for reasonable and light activity; he is permitted to wear conventional clothing in the usual manner (this is particularly applicable to enlisted men's jumpers); since the strap is easily adjusted by the patient,

teriorly. Both are angled toward the injured shoulder. When the plaster has "set," a heavy felt pad is placed over the prominent clavicle, and the belt is drawn over the padding and tightly secured to the buckle. If the strap is applied too far laterally, exerting pressure over the acromion the clavicle is not depressed, and in fact, the dislocation may be exaggerated. Recheck x-ray pictures, again taken with the patient holding a suitable weight, are advisable. A sling is worn the first week, and the device left in place from 4 to

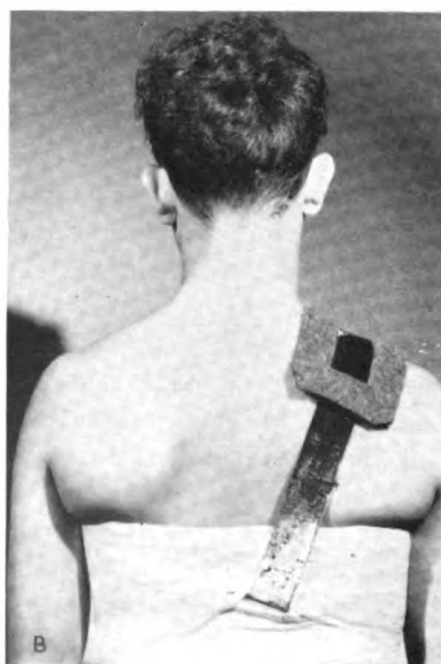


FIGURE 3.—Case 2. (A) Front view of apparatus in place. (B) Rear view of same apparatus.

constant pressure and hence reduction is maintained; every patient, without exception, said the cast and strap were comfortable to wear.

CASE REPORTS

Case 1.—C. A. W., 22-year-old male, sustained a right acromioclavicular dislocation while blocking in touch-football. Examination revealed tenderness over the joint, typical clavicular springiness and deformity, but no swelling or limitation of motion. After being treated for 6 weeks, he was discharged clinically and radiographically well. Follow-up film 3 months following injury is pictured in figure 2.

Case 2.—J. E. O., age 22 years, struck his right shoulder in an automobile accident and 2 weeks later entered the hospital without a diagnosis. X-rays disclosed a dislocation, and after reduction he was treated with belt and cast for 6 weeks. He was discharged with normal shoulder movement.

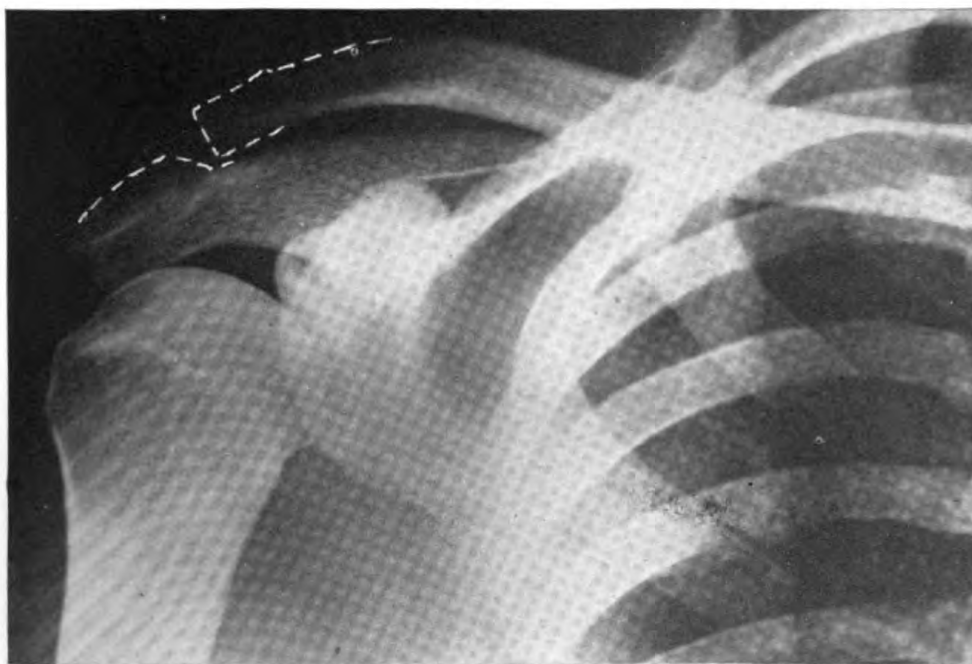


FIGURE 4.—Admission film of case 3 taken without traction to the extremity.

Case 3.—W. D. G., a 32-year-old veteran, who received bilateral acromioclavicular dislocations in an automobile accident, entered the hospital with symptoms and signs of a right dislocation. Three days later the left side was similarly diagnosed. He was treated for 27 days, and examination 3 months following injury revealed an excellent clinical and good radiographic result (figs. 4, 5, 6, and 7).

Case 4.—F. N. G., a 28-year-old officer, struck his right shoulder against an opponent's knee while playing touch-football, and experienced pain and tenderness over the joint. Six weeks later he was sent to the hospital where examination revealed an unstable joint. X-rays showed an acromioclavicular dislocation. After 2 weeks' treatment and upon the patient's request he was discharged prematurely with practically no benefit.

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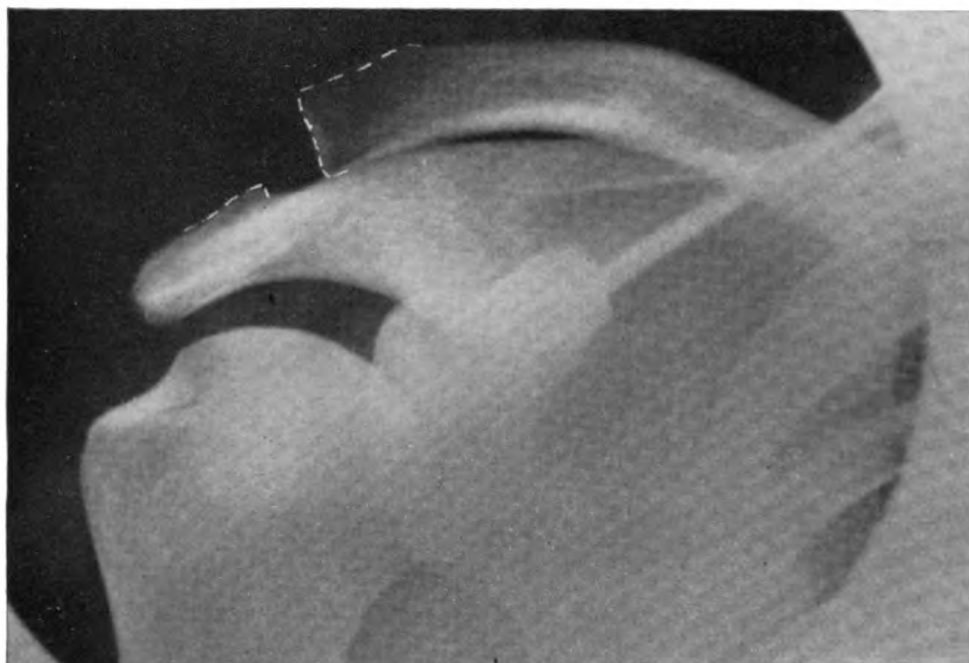


FIGURE 5.—A clear-cut dislocation found by x-raying patient in upright position with weight held in right hand.

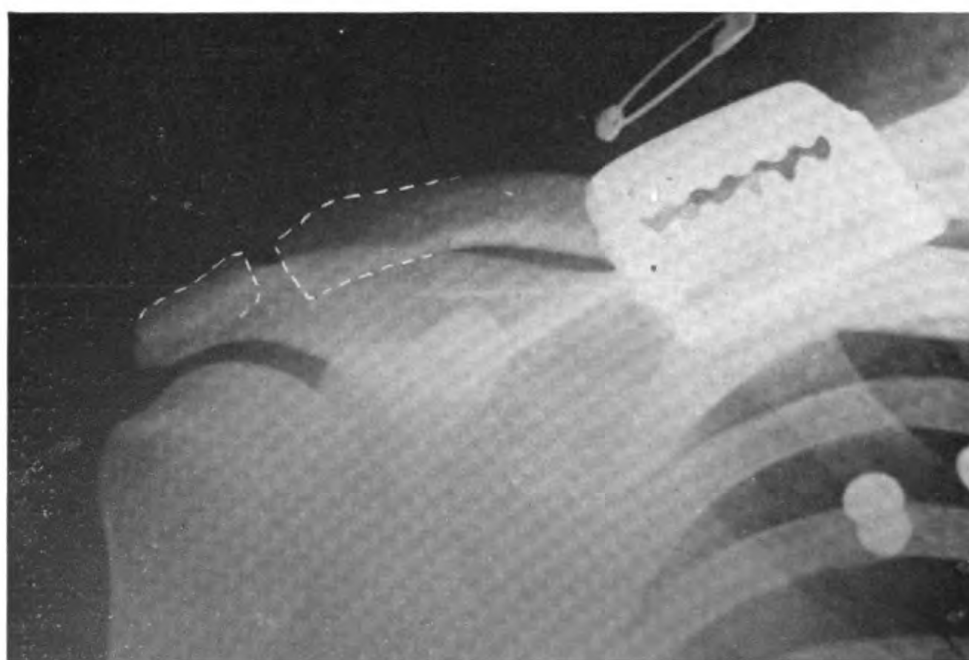


FIGURE 6.—The dislocation is completely reduced by application of the strap and plaster girdle.

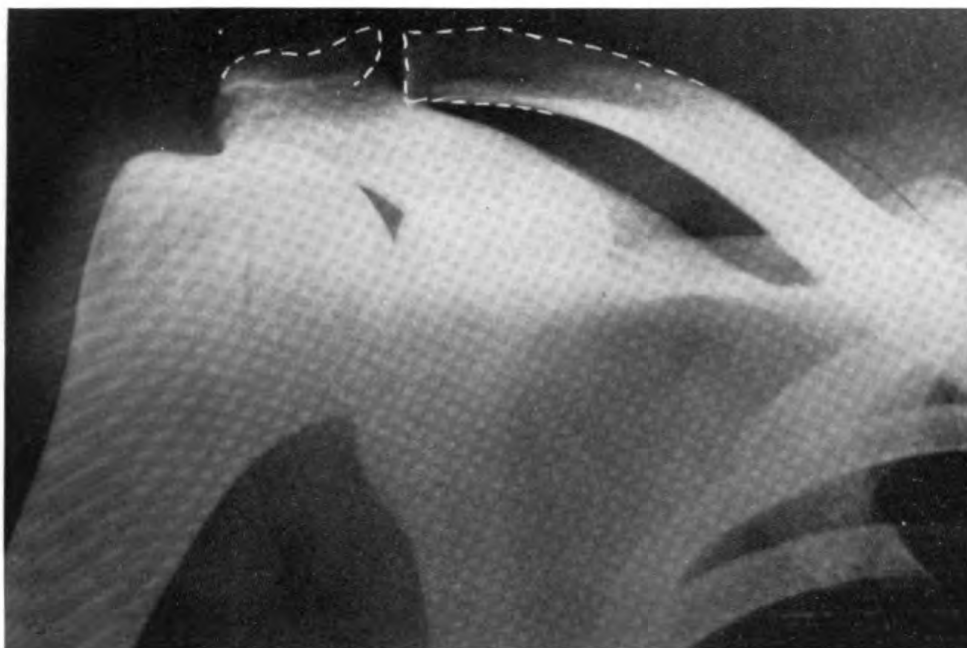


FIGURE 7.—Three months after the initial injury ; x-ray taken with patient holding weight in right hand reveals good reduction.

Case 5.—L. R. G., 20 years old, fell to the deck striking his right shoulder; he immediately experienced joint pain and noticed some limitation of abduction because of the pain. Examination showed tenderness over the joint, a depressable clavicle and a contour deformity. Tests excluded possible supraspinatous rupture. He was treated for 26 days and was discharged with a well-functioning joint.

Case 6.—J. W. B., a 24-year-old merchant seaman, struck his right shoulder as a result of a motorcycle accident. Presenting the usual findings of an acromioclavicular dislocation (fig. 8), he was treated for 4 weeks in the aforementioned manner. Two months after injury his shoulder was normal.

Due to the rapid transfer of military personnel, follow-up examinations are admittedly lacking in some cases. However, those patients checked at the end of 2 or 3 months have shown good shoulder stability, contour and motion; x-rays have uniformly revealed adequately reduced joints. The one failure, case 4, almost certainly resulted from too brief a period of immobilization of a 6 weeks' old dislocation.

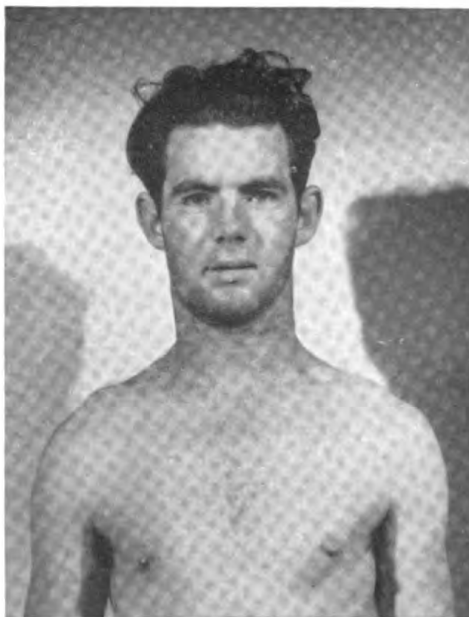


FIGURE 8.—Case 6. Deformity consistent with right acromioclavicular dislocation.

SUMMARY

1. The general features of acromioclavicular joint dislocations have been briefly described.
2. An undescribed method of immobilization of acute dislocations, using a plaster chest girdle and shoulder strap, has been described.
3. The records of six cases so treated have been included.

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DIAGNOSTIC VALUE OF OPSONO-PHAGOCYTTIC REACTION
IN HUMAN BRUCELLOSIS

The phagocytic reaction in human brucellosis is found to be more sensitive and dependable than the better known agglutination and skin tests, especially in the early stages of infection. Although not exhibited in all cases of brucellosis, the reaction is very marked in the great majority and remains strongly positive for about 2 years. The reaction apparently cannot be used as a criterion of resistance to infection.—UVAROV, A.: Diagnostic value of opsono-phagocytic reaction in human brucellosis. *Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii* (Moscow) 1943 (7/8): 66-72, 1943; *Biol. Abstr.* 20: 949, May 1946.

SINGLE INJECTION THERAPY FOR GONORRHEA

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In September 1945 at Pudget Sound Naval Shipyard, it was necessary for the venereal disease control officer to use a method of treatment for gonorrhea which utilized a minimum of time, space, and personnel consistent with a high rate of cure and which would be as painless as possible. Perusal of the current literature did not at that time reveal a suitable method. Lt. Comdr. William B. Chase, Jr. (MC), U. S. N. R., suggested that a method be used in which one parenteral dose of penicillin be given. This seemed feasible so permission was granted to try the method.

The cases of gonorrhea proved by symptoms, clinical findings, and microscopic evidence of gram-negative intracellular and extracellular diplococi, were treated in the following manner: The patients were given 200,000 units of penicillin dissolved in 4 cc. of normal saline per one injection in the gluteal region. The patients were denied liberty, but they were allowed the privileges of the Base and were instructed to report to the venereal disease control office at 0830 for the next 5 days in order that daily urethral smears might be made. If these smears were negative a culture of prostatic secretion was made on the last day and the patient instructed to return in 2 days for the results of the culture. If the culture was negative for gonococci, the patient was discharged, cured, and restored to a liberty status but required to have a blood Kahn in 2 months. The H-8 was written up with no sick days and a notation made that a Kahn was to be run in 2 months.

During the 5-day period following the single injection, if a positive urethral smear was found, an additional course of therapy was given. This course consisted of 200,000 units of penicillin in 8 cc. of normal saline given in 4 shots of 50,000 units each, 1 every 2 hours. At the completion of this course 5 additional smears and a culture of prostatic secretion were made. If these were negative the man was discharged, cured. However, if a positive urethral smear appeared during the second course of treatment, the following routine was

employed: The patient was hospitalized and given 400,000 units of penicillin, 50,000 units immediately and 25,000 units every 3 hours. At the completion of the injections 5 negative smears and a negative culture of material expressed from the prostate gland were required for discharge as cured.

STATISTICS

Number of cases given one injection of 200,000 units: 300.

Number of cases which showed a positive urethral smear after the initial dose: 41.

Number of cases which showed a positive urethral smear after the second course: 2.

Percentage of cure from one injection of 200,000 units: 87.

Percentage of failure from one injection: 13.

Percentage of failure to second course of multiple injections of Penicillin: 5.

The two cases hospitalized responded to the massive therapy. It is therefore obvious that no penicillin resistant strains of gonococci were encountered.

COMMENT

The percentage of cure from one injection, which was 87, is not quite as high as percentages of cure reported by naval medical activities using multiple injections of penicillin. The time and space saved, plus the ease of preparation of a single dose in normal saline was significant. The relatively painless procedure was a benefit to the patients. It is felt, therefore, that the use of single injections of penicillin for the treatment of gonorrhea is justified.

NUMMULAR ECZEMA AND PROSTATITIS: ITS TREATMENT WITH PENICILLIN

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Most observers have considered nummular eczema as a definite clinical entity. However, there has been no agreement as to its etiology. When it was found by Schoch (1) that improvement or cures could be obtained with the use of sulfonamides, it was conceded that part of the etiology might be explained by bacterial allergies.

In accord with these views are the Suttons (2) who recommend for its treatment "removal of tonsils, eradication of dental, sinus, and vaginal foci, in addition to 0.5 gram of sulfapyradine with each meal for 9 doses." They also prescribe antiseptics for its local therapy. Sulzberger (3) advances the theory of its possible virus etiology with the resulting eruptions resembling in type a fixed "id." Furthermore, it was his impression that removal of tonsils was distinctly beneficial.

The diagnosis of nummular eczema depends on the presence of typical oval coin-sized plaques of erythema with papulovesicular borders and scaly centers resembling a fungus infection, but located for the most part in a symmetrical fashion. These are found on the dorsum of the hands and fingers, the superior part of the feet, the ankles, and occasionally other patches are found extending up the extensors of the forearms and arms, legs, thighs, and on the body. In some of our patients it was not always possible to make this diagnosis with certainty, as previous ointment therapy and secondary infection had changed the clinical picture. Therefore, it was necessary to depend on configuration, symmetrical distribution, history of recurrence, and the occasional outbreaks of peripheral papulo-vesicles in old oval lesions as further guides. Contact dermatitis could be ruled out by negative patch tests to occupational irritants and shoe leather, as well as by prevention of exposure to irritants by strict

hospitalization. All skin lesions were thoroughly searched for fungi and found negative before the diagnosis was established.

During the winter months when recurrences of this disease are more prevalent, careful investigations were made of all our patients with nummular eczema to determine any possible foci of infection. These included thorough searches, both clinically and by x-ray in the ear, nose and throat, dental, and genito-urinary departments. We were particularly impressed by the high incidence of prostatitis (47 per cent) found in the naval personnel that had this disease on the skin of the feet and ankles alone, or in association with lesions on the backs of the hands and fingers. During this same period of study we rarely observed these skin lesions on the feet or ankles of the Navy family dependents, although it was not uncommon to find the eruption on the extensor surfaces of the fingers, hands, and upper extremities.

TABLE 1.—*Distribution of focal infection in nummular eczema*

	Number of cases	No foci found	Ear, nose, and throat department	Dental department	Genito-urinary department
Eruption—dorsums hands and feet ¹	11	2	4	2	5
Eruption—dorsums feet only.....	8	0	3	1	4
Total.....	19	2	7	3	9

¹ There were 2 cases where a dual foci of infection was found.

TREATMENT

As our previous experiences had demonstrated that all patients with nummular eczema did not respond satisfactorily to administration of sulfonamides, as well as the fact that prostatic infections were caused by cocci in most instances, it was hoped the penicillin administered intramuscularly would be more effective in the therapy of both conditions.

In the majority of the patients so treated there was an immediate improvement in the appearance of the eruption. The crusted papulovesicles at the borders healed quickly, edema disappeared, pruritus was relieved and only a slightly erythematous area remained at the site of the previous eruption. Occasional exacerbations occurred when penicillin injections were discontinued, but these were of lesser severity than the original eruption.

The prostatic secretion in most cases showed progressive improvement in the amount of pus contained in the samples that were expressed weekly.

In spite of the precautionary use of gradually increasing dosages of penicillin, which started with 2,000 units and progressed to 15,000

TABLE 2.—*Results of intramuscular penicillin injections in the treatment of nummular eczema and prostatitis*

Initial	Age ¹	Location of eruption	Admis- W. B. C.	Penicillin dose, total units	Condition of eruption	Prostatic infection	Other reaction
L. B. S1/c	39	Dorsum feet and ankles	8,400	225,000	Marked improvement	Cleared	None.
J. W. H. F2/c	24	Dorsum hands and feet, exten- sors forearms.	10,350	200,000	Moderate improvement	do	Chill, headache, fever 102°F., leu- kocytosis 17,350, aggravation of eruption which later improved.
W. P. S. A/S	23	Ankles	8,400	74,000	Marked improvement	do	None.
J. A. T. F1/c	21	do	7,350	500,000	do	Recurred	Do.
C. B. E. S2/c	20	do	6,300	200,000	Not improved	Cleared	Do.
C. V. L. C1/c	25	Dorsum hands and feet	9,000	250,000	Marked improvement	Improved	Do.
G. R. F. F2/c	31	Dorsum hands, ankles	11,050	934,000	Slight improvement. Recurred 2 weeks later.	Improved slightly	Do.
L. J. H. ScM3/c	28	Arms, right foot	6,050	580,000	Marked improvement	Improved	Do.
J. L. S1/c	35	Feet, legs, hands, forearms	10,500	80,000	do	do	Aggravation of eruption, later im- proved.

¹ All patients were male.

units in the first 6 to 10 injections, there was an initial aggravation of the eruption in 2, with a febrile reaction and leukocytosis in 1 of these patients. As has been previously demonstrated, these "Herxheimer"-like flare-ups (4) can be controlled by reducing the amount of penicillin given at each injection. Furthermore, such reactions serve a useful purpose in effecting an improvement in the skin lesions when the penicillin is discontinued. It is our opinion that such aggravation, in patients who have not previously had penicillin, proves the skin disease so affected is caused by bacterial allergy and not by hypersensitivity to foods, contacts, metabolic, or neurogenic factors.

Because we have not been able to follow the course of these patients after discharge from the hospital, we cannot estimate the incidence of recurrence of either the skin lesions or the prostatic infection. Of the nine cases reported, only one had a recurrence of the skin lesion within a period of 2 weeks.

Ointments containing penicillin 400 to 500 units per gram in various forms of grease type, or "oil-water" emulsion bases were also used in the treatment of nummular eczema (5). The secondary surface infection, crusting, and much of the pruritus was quickly relieved when the ointment was applied twice daily. This improvement usually occurred within 4 days when the "oil-water" emulsion base was used and more slowly when a grease base was selected. We are in agreement with Templeton (6) that the local use of this ointment alone is not sufficient to clear up the entire eczematous process, but further therapy with x-ray, tar ointments, and vaccine injections is also necessary.

SUMMARY

1. In approximately half the patients with nummular eczema on the dorsum of the feet, a focus of infection will be found in the prostate.
2. Intramuscular injections of penicillin will produce a rapid improvement in the skin lesions and is helpful in reducing the infection in the prostate.
3. Penicillin should be administered in gradually increasing dosages to prevent severe "Herxheimer"-like reactions.
4. Penicillin ointment applied locally to the areas of nummular eczema will produce a rapid temporary improvement.

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FROZEN VITAMIN STANDARDS

Preparation of accurate standards for vitamin analysis is time-consuming, and in most laboratories fresh standards are prepared every few days; riboflavin solutions undergo photolysis, and thiamine in dilute acid is unsafe to use if it has been stored more than a few days. The use of frozen vitamin standards is both accurate and time-saving. A large number of vials can be prepared and used over a long period of time. This method can be used for other vitamins also.—STANBERG, O. E. and BOLIN, D. W.: Frozen vitamin standards. *Indust. & Engineer. Chem., Analyt. Ed.* 17: 673, 1945; *Biol. Abstr.* 20: 884, May 1946.



RELATION OF THE ADRENAL CORTEX TO ARTHRITIS

Author's summary.—Experiments designed to study the relation of repeated injections of desoxycortone to rheumatic lesions in the rat are described.

It has not been possible to show that desoxycortone is a factor in the causation of arthritis in rats.

Infection, either directly or indirectly, is intimately concerned with the production of rheumatic cardiac lesions and nephrosclerosis.

Low air temperature may also play a part in the aetiology of nephrosclerosis and rheumatic cardiac lesions, and should be considered in future experiments.—HARRISON, R. G.: Relation of adrenal cortex to arthritis. *Lancet* 1: No. 22, 815-818, June 1, 1946.

PSYCHIATRIC EVALUATION OF THE NAVAL DELINQUENT

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Although actual hostilities have long ceased in the recent two-ocean war, yet the problem of delinquent conduct among naval personnel still presents an imposing question for consideration even in peacetime. To that end, so-called naval retraining commands have been established in various parts of the country for the study and consideration of the typical naval offender.

Chappel (1), in a statistical study conducted by the Corrective Services Division of the Bureau of Naval Personnel, found that only one-third of 1 percent of the combined strength of Navy, Marine Corps, and Coast Guard was in confinement at any time as a result of trial by general court martial. This low percentage of delinquency, he believed, was due to a variety of causes among which were:

1. High caliber of service personnel motivated by due patriotism and love of country and the freedom for which one engaged in battle.
2. The Navy's high standard of indoctrination, discipline, and leadership.

Chappel also revealed that the number of naval personnel in confinement at any time during the last war was 1 percent lower than the high peak reached in World War I. It may be concluded, then, that although the problem of delinquency is a serious one, yet it involves but a small percentage of naval manpower. Studies made by the Bureau of Naval Personnel point out also that 94 percent of all naval prisoners have committed military offenses involving unauthorized leave or absence over leave, whereas only 6 percent have committed offenses which ordinarily would land an offender in civilian court, such as theft, assault, sex offenses, and the like.

The author had a tour of duty as naval psychiatrist assigned to the special type of naval disciplinary establishments on Yerba Buena Island in San Francisco Bay where were located the brigs and the various naval courts and was present at Captain's Mast and observed every type of offender from his first appearance before the commanding officer to his later appearances at a deck, summary, or general court martial. Every prisoner was given a complete neuropsychiatric

study, and any special request, be it from judge advocate, the defense counsel, or the prisoner himself, was honored by a more complete review including a social service study. It is from this general group that some 2,000 cases have been chosen to reveal the types and percentages in contradistinction to a group of 13,727 men who were screened "off the line" in a naval training station (2).

In the interest of thoroughness this pertinent problem has been approached along lines of social control and the inquiry pressed in different directions. A questionnaire was devised in detail so that considerable data could be obtained from the numerous headings (3). It was then given to the 2,000 men who were told that the material thus obtained would not be used against them, and that they need not sign the questionnaire unless they wished to do so. Each prisoner filled out the questionnaire in private, which took about 20 minutes. The questionnaire itself was designed as an adjunct to the personal neuropsychiatric interview which was given routinely. The neuropsychiatrist was always on the alert for any psychiatric problem which might have been a definite motivating factor behind the specific offense. In many cases, if the problem became sufficiently important, the man was not allowed to go to the brig but instead was sent to the hospital for a more detailed study.

TABLE 1.—*Neuropsychiatric diagnosis in discipline cases*

Diagnosis	Cases	Diagnosis	Cases
Constitutional psychopathic state (all types)	282	Somnambulism	6
Psychoneurosis (all types)	216	Enuresis	8
Combat fatigue	21	Immaturity	6
Operational fatigue	12	Mental deficiency	12
Pathologic sexuality	50	Motion sickness	2
Schizophrenia	2	Conscientious objector	3
Schizoid personality	1	Neurological disorders	7
Personality disorder	16	No disease	1,585
Chronic alcoholism	14	Total	2,046
Drug addiction	3		

TABLE 2.—*Summary of neuropsychiatric discharges among inductees*

Diagnosis	Cases	Diagnosis	Cases
1. Constitutional psychopathic states	4,280	6. Migraine	236
a. Inadequate personality	2,294	7. Somnambulism	562
b. Emotional instability	164	8. Convulsive disorders	441
c. Sexual psychopathy	98	9. Illiteracy	390
d. Paranoid personality	118	10. Neurological disorders	540
e. Criminalism	73	11. Alcoholism	897
f. Schizoid personality	86	12. Immaturity	236
2. Psychoneurosis (all types)	3,419	13. History of psychosis	74
3. Mental deficiency	1,043	Total	13,727
4. Enuresis	876		
5. Post-traumatic syndrome	683		

DISCUSSION

The early work of Locke, Cornsweet, Bromberg, and Apuzzo (4) revealed that in a group of 1,063 offenders there was a loss of some 90 man-years of service through the aggregate absences. These authors were also in agreement with Chappel in that they found only a very small percentage of the total naval manpower involved. It may also be pointed out, however, that in pre- or post-war civilian life one may remain away from his job without permission. During a war this may be considered unpatriotic but not illegal. However, naval absence without leave or absence over leave, particularly when the offender misses the sailing of his ship, is absent from a draft, or misses his mobile unit, can become a very serious offense. Finally, if absences continue in great numbers they can have very serious consequences insofar as war effort or military organization in peacetime is concerned. What, then, is the cause of delinquent conduct among naval personnel? What is the relationship of the delinquency to family difficulties? What are some of the fundamental emotional and environmental causes? Usually there are surface reasons and deep reasons. In a former study were listed some routine ones given by men to excuse themselves for having taken unauthorized leave (5):

Frequent Reasons for Unauthorized Leave

- | | |
|---------------------------------------|---|
| 1. No reason. | 21. I wanted to get married. |
| 2. I did not like my present duty. | 22. I got sick while on leave. |
| 3. Sickness in the family. | 23. Couldn't get along with officers on ship. |
| 4. I got drunk. | 24. I felt like staying over. |
| 5. Not enough leave—no leave. | 25. Fear of the sea. |
| 6. Trouble at home. | 26. Didn't like Navy regulations. |
| 7. I overslept (hotel didn't awaken). | 27. I am a homosexual. |
| 8. I didn't like ship I was on. | 28. Trouble with shipmates. |
| 9. Train was delayed. | 29. Thought they were trying to frame me. |
| 10. Can't stand work on the ship. | 30. No opportunity for advancement. |
| 11. Wanted foreign duty. | 31. Mother kept me home—under age. |
| 12. Requested sea duty. | 32. Afraid of combat. |
| 13. I objected to restriction. | 33. I am best suited for civilian work. |
| 14. Wanted to visit my family. | 34. I thought I wouldn't get caught. |
| 15. Because nervous on job. | 35. Detained by civil police. |
| 16. Do not like the Navy. | 36. To see girl friend. |
| 17. Didn't get proper medical care. | 37. Can't keep away from girls. |
| 18. I was homesick. | 38. Didn't want foreign shore duty. |
| 19. I wanted to have some fun. | |
| 20. I wanted to see my wife and baby. | |

It is not difficult to understand that overindulgent mothers might influence sons, or that overdependent wives might cause husbands to become naval offenders. These relatives hardly seem to realize that in so doing they become accomplices in a military offense. It is not at all uncommon for a disciplinary establishment to receive letters written

by relatives explaining reasons for a husband's or son's absence and at the same time asking for mitigation or amelioration. Such a letter is received very quickly when allotments are discontinued. The family does not seem to be able to understand that inasmuch as a prisoner is contributing no service he cannot receive pay; or that a bad conduct discharge or even a dishonorable discharge deprives the prisoner of his mustering out pay and the benefits provided by the G. I. Bill of Rights. It is difficult, obviously, to ask relatives of service men to withhold distressing information from them concerning family stresses and problems, nor can we ask them always to write cheerful and encouraging letters. In many instances such as in the following illustration does one continue to offend.

Example.—L. J. D., S2c, a farmer from Minneapolis was AOL or AWOL each time his wife wrote him a letter actually "sending" for him. Once he had to do the painting of a fence, another time to help at the delivery of an expected baby, the third time to help bring in the crop, and the fourth time to replace a drunken farm hand.

There is a degree of goodness in every man, but with strength and weakness in all, not all men outside of prisons are necessarily good, nor are all men in confinement entirely bad. Actually, the author has seen few men in naval custody who were really vicious and anti-social. For the most part they were only irresponsible and inadequate. Over a long period of time traces of weakness may be revealed. Usually these men originated in homes which were broken, dislocated, and loaded with strife. The routine history revealed poverty, lack of security, neglect in infancy and childhood and continued lack of affection later, difficulties in school, on the job, and in the community. These men have records of shifting jobs and numerous arrests and apprehensions. When a difficulty arises they seem able to do only one thing—run away. That was their reaction also in the naval service. Whenever pressure, either on shore establishments or aboard ship became acute they would take unauthorized leave. Actually, should a more pleasant situation than the one existing at the present time offer itself, the naval offender will choose the former. Many a man who has been at sea for a long time, or in a foreign post for several months with a perfect conduct record, will, upon arriving in the United States ask immediately for leave which he considers he deserves. It is understandable that such leave must sometimes be refused, with the result that the man goes AWOL.

What, then, are the deeper reasons behind these offenses? First, table 1 reveals that in this sample group the psychiatrically sick were definitely a minority. In other words, the great majority of these men were considered mentally well. However, they did exhibit personality difficulties which eventually brought them before the naval

courts of justice. Many of them were salvageable and for that reason certain cases interesting enough for study and research will be presented later in this paper.

Many men in this group reveal in their rationalizations definite neurotic reactions. For example, some pointed out that their officers looked frightened in combat or at sea which is explainable as projected anxiety. Many a man complained that sea duty was monotonous enough to be feared thus revealing his own insecurity. During the war some of these Navy men stated that they preferred the Atlantic Theater to the Pacific Theater, which was again immaturity.

Locke, Cornsweet, Bromberg, and Apuzzo advanced the following reasons for naval offending. The average youth who enters military service during wartime is subjected to a new kind of life differing considerably from his previous one. Some can adjust to restraint and to authority while others cannot. Bromberg, Apuzzo, and Locke (6) noted that the basic difficulty in desertion and similar offenses lies first in the overt reaction of anxiety induced by frustration of some sort, and second, that there is an antiauthoritarian attitude and anxiety which produce antagonism toward authority and discipline. Otness and Stouffer (7) felt that actually this may be allied to adolescent rebelliousness which may sometimes arouses guilty feelings and later anxiety. A separation anxiety may be seen at training center, in combat areas before, during, or after battle, or even in peacetime. These anxiety attacks may be numerous and may include headache, dizziness, backache, heart pains, and gastric disorders. Brady and Hildreth (8) observed similar findings in a disciplinary group in naval hospitals. Occasionally enuresis and preoccupation with sexual difficulties may be seen among those who leave ships illegally. These men may worry about masturbation or may have a fear of being impelled to attack shipmates homosexually. Leicher (9) predicted much of this behavior in a group of new recruits, an observation also made by Baganz (10).

Example.—J. H. D., MM2c. A 19-year-old male was over leave giving as his reason that he had feared he was homosexual and therefore went AOL for 10 days, during which he lived with a girl whom he had picked up in order to prove that he was sexually potent. His history revealed poor sex training, a marked mother attachment, and, in general, inadequate preparation for the service.

Occasionally a man will wish to be alone, stating that he is intolerant of noise, and will become irritable and wish to fight anyone. Usually these fantasies appear at night during which time a man could actually become wild and destroy anything about him.

An important dynamic force behind naval offending is the inability to stay away from home. Early insecurity developed by this situation

may be replaced by an anxiety symptom, tolerated for a short time, but eventually overwhelming the individual. Especially here is seen the extreme parental attachment, particularly of the matriarchal type.

Example.—D. A. R., S2c, age 17, a member of a closely knit Italian family in which he was the youngest child, was AWOL for 7 months because his mother cried incessantly when he was at home on leave. As he was about to return to duty she told him she had had a dream in which he was lost when his ship was sunk. He was, of course, easily persuaded to remain at home.

Anxiety due to separation from home and mother is rarely found to be uncomplicated for usually there is seen some element of hostility directed against the parents. This hostility is explained as a defense against deep dependency needs which the individual cannot express freely and which, therefore, he transfers to the Navy and its officers.

Antiauthoritarian attitudes are also allied to separation and it may be found that a complaint such as sea sickness may mask hidden hostilities toward officers as parent surrogates. This group is independent, self-willed, has fun at its own convenience, and outwardly hates officers. This type of behavior may be seen in the rebellious immature adolescent, up to and including the murderer. Most of them have some neurotic ailments. When seen by the psychiatrist it is easily demonstrable that beneath the cloak of arrogance may be seen dependencies which have never been completely eradicated. Rarely will these men obey orders because this means to them weakness. With punishment, their antagonism toward authority increases. In other words, then, we have here on the one hand antagonism toward authority, and on the other, dependent needs; these two together with fear produce illegal behavior.

What is the make-up of the ordinary offenders? He is usually seen to be basically not delinquent, but rather, immature and poorly indoctrinated from the military viewpoint, and quite incapable of adopting a good attitude toward military requirements. As a matter of fact, he considers his offense no more serious than being truant from school. Usually he is the youngest in the family, sometimes an only son. The family itself has been loosely knit with poor supervision of the children. The offender always enjoyed freedom from restraint, left school because he didn't like it, boasts openly of the number of his truancies, but decries his poor occupational record as well as his feeble social contacts. He does not mind stating that the Navy ought to send him home and keep him there. Since the ship doesn't please him he might as well be transferred to another, etc. We see, thus, poor indoctrination in this immature individual whose background of inadequacies can hardly make of him good naval timber.

Another common group of offenders are those who were accustomed to moving about without restraint. These, too, were fundamentally

nondelinquent. They were asocial but yet held responsible jobs with good wages. Induction was never eagerly sought. They liked their home comforts, were closely domesticated, attached to wives, mothers, or grandparents, and had many family responsibilities. When refused liberty or leave, they simply return of their own accord to the scene of their emotional problems. They deny vehemently their exaggerated sense of loyalty to their families and state that consideration for country comes first with them. They reveal strong egocentric qualities and all through life carry on a veritable tug-of-war with authority, regimentation, and restraint.

Example.—P. J. F., S2c, in a period of 10 months in the service, all "State-side," had two offenses including a 2-day AOL with ship missed. It was noted that he was markedly attached to his wife who considered him rather in the light of a child because of his numerous indefinite ailments. In spite of this type of make-up, the man was making a salary of \$15,000 a year as secretary to the president of a nationally known firm.

CONSTITUTIONAL PSYCHOPATHIC INFERIORITY

This large group actually forms one of the most disrupting elements in society, not only in wartime but in peacetime as well. A true psychopathic personality is one who appears normal on the surface, but has a deep-seated abnormality causing him to be an inveterate troublemaker. I quote the description of this disorder as given by the Surgeon General of the United States Army:

Under this heading is placed an ill-defined, more or less heterogenous group of conditions in which the patients, although they do not suffer from congenital defect in the intellectual sphere, manifest a definite defect in their ability to profit by experience. They are unable to respond in an adult social manner to the demands of honesty, truthfulness, decency, and consideration of their associates; they are emotionally unstable and not to be depended upon; they act impulsively, with poor judgment; they are always in conflict with the law. They do not take kindly to strict discipline. Such persons have a decided influence upon their associates, and upon the morale of the organization, for they will not conform to recognized authority and they derive much satisfaction from cultivating insubordination in others. Frequently they make a favorable impression, are neat, talk well, and are well-mannered. In this general group are to be placed many homosexual persons, grotesque and pathological liars, vagabonds, inadequate personalities, petty offenders, swindlers, kleptomaniacs, alcoholic persons and, likewise, those highly unstable and arrogant persons called pseudoquerulents ("guardhouse lawyers") who forever are critical of authority and imbued with a feeling of abuse and lack of consideration of their fellows.

Neuropsychiatrists early in the war encountered many of these psychopaths who came into the Navy through the efforts of well meaning, but short-sighted judges before whom these men had appeared charged with some crime. The well-intentioned, but poorly informed judge would rule, "I will suspend sentence if you will enter the armed

services." Some branch of the service then acquired another troublemaker. This practice was discouraged, but it took time to educate the judiciary.

The psychopath is usually seen to be a rather intelligent and well-built individual, who, at a casual glance may impress one favorably, but the psychiatrist soon identifies him as the chronic misbehaviorer whose history will reveal that since childhood he has been a difficult problem at home, school, at work, and in the community. He is most skillful in offering excuses and often so deft and glib that he can talk himself out of any difficulty. When he is discharged from the Navy, no matter what his type of discharge, those who know him will remark that once again he has been able to evade his responsibility. Such instances arouse the resentment of shipmates and of the general public, but these men must be handled realistically, for they are "bad actors." Ordinary persuasive reasoning or even punishment cannot reach them, and it is questionable whether time and energy spent on their training or rehabilitation is worth while. Medical men in the service feel that the Navy is better off without them. Actually, later and better information must be obtained on them for they do need help.

Example.—R. L. M., Pvt. U. S. M. C., a 22-year-old male whose preservice record revealed poor schooling with two grades failed, a shifting job record with numerous discharges, drinking since his sixteenth year, and many apprehensions by the police. During the past year before being picked up on a long AWOL charge it was found that he had been married three times. His service record over a period of 5½ years revealed 61 Captain's Masts, 2 deck courts martial, 2 summary courts martial, and 2 general courts martial. He had been "busted" twice. Charges included AOL, AWOL, sleeping on watch, disobedience of orders, stealing a caterpillar tractor, a jeep, a motorcycle, a plane; playing with crooked dice, throwing a firecracker at a Marine general, striking officers, and other misdemeanors.

PSYCHONEUROSIS

In this group we find men with physical and mental symptoms of psychogenic origin. The decision to be made is whether or not the condition is so severe as to warrant rejection. If the man's symptoms have not prevented him from working regularly and maintaining a normal family, social, and occupational routine, he is rarely considered a medical problem. Some attempt is made to give the individual insight into his condition.

The psychoneurotic usually unconsciously converts his anxiety into physical symptoms. These, in the autonomic spheres, are the familiar flushing, sweating, tremor, dermatographia, the so-called "irritable" or "soldier's heart," or "effort syndrome," stomach difficulties, dyspepsia, diarrhea, and frequent urination. The neurotic

cannot overcome his nervousness no matter how hard he tries, even if he is honest. The more he attempts to control himself the more nervous he becomes. He gives a history of regularly visiting dispensaries asking for the cause of his "nervousness." Encountered are cases of the so-called conversions, such as hysterical paralysis, motor and sensory defects. If these complaints are such that a definite physical cause cannot be found, an attempt is made to ferret out the etiology elsewhere. If handled properly and wisely the individual may be saved for useful service after discipline has been completed.

Under the psychoneuroses are listed the amnesias, a condition encountered regularly. The term "amnesia" has been used loosely to include any temporary loss of memory. It is generally suggested that this must also include loss of one's identity as well as loss of memory for time, place, names, and events. The most frequent causes are: (a) alcohol; (b) pathological or physiological brain disturbance; (c) disturbed physiology of the brain such as is found in epilepsy, so-called post epilepsy fugue, or furor, for which the patient is amnesic and during which crimes may be committed. The literature is replete with writings on the relation of epilepsy to crime; (d) psychological causes in which one deals primarily with hysterical fugues which usually clear up within 24 hours—others within a few months; (e) functional psychoses as may even be seen in depressions; (f) feigned amnesias which generally present the greatest problems.

For example: A prisoner has committed a misdeed and his immediate defense is to disclaim any memory of it. Usually it is rather easy to detect such simulation because the misdeed is planned and the motive, therefore, apparent. The patient, upon repeated questioning, usually gives himself away. However, a detailed history of the patient's life frequently reveals him to be a psychopathic personality with rather good intelligence and it may be necessary to resort to other sources of information such as friends, families, and social agencies for the complete picture. Sometimes a period of observation is needed to permit persistent questioning in an effort to determine the consistency of the patient's behavior. I might add that a case of true amnesia, if it exists in a hysterical type of individual, warrants leniency. Occasionally, with the approval of the courts and with the consent of the prisoner, hypnosis or narco-synthesis may be employed. As might be expected, the longer a man has been "over the hill" the more likely is he to say that he does not remember what he did during that period of time.

Example.—L. M. S., S2c U. S. N. R., revealed a preservice record including poor environmental origins, a broken, dislocated family, schooling only through the fifth grade, a poor work record, numerous arrests for diverse offenses including petty larceny, maltreatment of children, vagrancy, and a history of three divorces. In service over a period of 20 months, all "State-side," he had an AOL charge

of 14 months. Narco-synthesis revealed that he had picked up a woman in Los Angeles with whom he lived for 14 months during which time he worked driving a truck. During the interview he stated that he often wanted to return but that he "just didn't have the nerve."

THE FATIGUE STATE

There were many men with combat or operational fatigue who had committed offenses. They fell into two groups, each with particular motivating dynamic factors. Those in which anxiety symptoms were dominant often developed states of maximal fear and in panic ran away from their ships or bases. Had they remained they would have found themselves in a situation where the conflict between the dominant instinct of self-preservation and the danger incident to combat would have been enhanced to an excruciating degree, making unbearable the anxiety symptoms they already possessed. The other group had dominant symptoms of hostility and resentment. They were almost paranoid in the expression of their resentment which was directed toward their superiors who stood to them for parental substitutes who had failed to protect them. It seemed to them that their officers conceived plans to lead them into the combat zone as an expression of personally directed aggression, and the patient prisoners displayed their resentment and frustration by counteraggression.

The dicta for combat or operational fatigue as presented by Raines and Kolb are: (1) increased tension and restlessness; (2) insomnia and battle dreams; (3) startle reaction and personality changes with emotional instability predominating; (4) irrational sense of guilt.

We had about 20 patients who came under this category and they were restored to full duty when they were discharged from a special hospital to which they were sent from this station.

Example.—J. A. H., WT1c. U. S. N., had been in service for a period of 6 years most of which time had been spent at sea participating in practically every major offensive of the war. Symptoms of combat fatigue in this man increased to such an extent that he finally went AOL for 15 days, but later turned himself in, voluntarily. Subjective symptoms and objective evidence were so clear-cut that he was hospitalized, his condition treated, and he was restored to duty with no charges.

PATHOLOGICAL SEXUALITY

This large group of cases included the numerous homosexuals usually encountered. To evaluate these individuals was sometimes a very difficult task. A patient might have been a basic homosexual all his life, or he might have been a homosexual by chance, by opportunity, by profit, or by social gain. Occasionally he revealed his latency under the influence of alcohol or other drugs. Naturally we looked for psychic traces of effeminacy such as may appear in taste,

in thinking, in gait, in actions, but these are not always present in either the passive or active types of homosexual. Many of these men protested loudly that they had had or were capable of having heterosexual experiences, but it is well known that homosexuals have the usual heterosexual wishes and longings, but that they are repressed because of deep seated fears of heterosexuality. Childhood sexual experiences of a fearful nature, especially those due to severely repressive parental attitudes toward such expressions as sexual curiosity, sex play, and masturbation, may, in the child's development, shift him toward homosexuality. Such an individual is likely to reach maturity with many fearful associations with heterosexuality. Under Navy conditions such as present in submarines or other ships, in close quarters, homosexual behavior may break out in men whose previous behavior has been consistently heterosexual. This was also seen at times in some of the brigs.

Example.—J.D.S., PhM1c, revealed in his preservice record a poor marital history with three marriages "on the rocks." Over the period of 4 years and 3 months he had been in the service he had done considerable drinking and upon two occasions was accused of immoral behavior and drunkenness. His last accusation had been accompanied by numerous witnesses to his homosexual activities. He revealed, characteristically, a high pitched voice, feminine body configuration, and was egocentric and satirical. Other psychic traits of effeminacy including taste, mimicry, thinking, and gait were present. Investigation revealed basic homosexuality throughout his entire life.

PSYCHOSIS

Rarely was there seen a case of frank psychosis. Upon numerous occasions men were brought in with acute psychotic episodes following extensive drinking.

Example.—R. S., F1c, appeared of his own accord stating that he was depressed, suicidal, and that he was being "forced" into his type of disturbed thinking. Mental content revealed hallucinations, delusions, and paranoid thought. He wrote a suicidal poem but was thwarted in an attempt to kill himself.

ALCOHOLISM

Alcoholism was the old bugaboo which was always present particularly in some of the older individuals who were slated for discharge diagnosis of "over age." Those who had been on foreign duty would, when they returned to this country, go out on a drinking bout and be returned in discipline status with every sign and symptom of acute alcoholism. There were some who presented signs of true chronic alcoholic deterioration, but they were in the minority. Most of the

men who came to my unit had signs of acute alcoholism. Some developed definite alcoholic hallucinations while in the brig. There were several cases of impending D. T.'s. These men stated that they had begun drinking at a fairly early age and had continued all through life.

Example.—R. B. M., S1c, in his preservice record revealed a long checkered history of inadequacy based upon alcoholism. He had been drinking since the age of 14 years, and admitted to having lost at least 20 jobs because of alcohol. In the service over 1½ years, he had appeared at Captain's Mast 6 times, all on drinking charges. Actually he revealed no deterioration per se, but it was obvious that he could not adjust in the service and was discharged.

DRUG ADDICTION

Now and then I saw an occasional addict who was either referred for smoking illegal cigarettes or who had turned himself in because he feared he was going insane. When a suspected narcotic user was apprehended, it was the policy to investigate the entire barracks for the use of the drug usually centers in a group. At no time was anyone seen in an advanced stage of marihuana addiction. Cocaine and opium ran second and third to marihuana as the drug of choice, probably because these two were more difficult to obtain.

SOMNAMBULISM AND ENURESIS

Both these conditions were occasionally seen, but more particularly in those individuals who were in the brig. Customarily the prisoner reported his problem to the guard who then brought him to the physician for examination. In many cases the enuresis was found to be willful. Somnambulism, too, was seen to exist when men were in custody. Red Cross Social Service reports were usually obtained on these men, and close checks made were to ascertain the validity of their complaints. In any event these men had to serve out their sentences.

IMMATURITY

Occasionally young men of less than the approved age were brought in for evaluation and, in spite of their good past records, many were eliminated in terms of immaturity. An intellectual evaluation of these men was first made. Many begged to be permitted to remain in the service, stating that they would fulfill their sentences and return to service because they were at least physically mature.

Example.—M. C., S1c, was found through a social service study to be but 13 years of age. He had bribed a woman to pose as his mother to sign his service certificate of consent. In the service over a period of 8 months, he had a series of six offenses.

MENTAL DEFICIENCY

There were a good many men encountered who were found by psychometric examinations to be mental defectives. The Kent test, checked later by the Wechsler-Bellevue scale, revealed their classification.

Example.—E. E. S., S2c, a dishwasher aboard a cargo ship with a preservice record of just two years of schooling, had been a farm hand in a very backward community. He was now apprehended for drinking heavily and stabbing a shipmate. His psychometric performance yielded an IQ of 39 on the Wechsler-Bellevue scale, classifying him as an imbecile.

MALINGERING AND SUICIDE

Malingering is much less commonly seen than is generally supposed. Simulated suicide was not uncommon, usually a gesture in which, for example, a wrist was scratched with a razor blade. Pseudosuicide attempts included pseudo-strangulation just before a guard was to pass a cell, drinking of antiseptic foot baths, swallowing pins, electric bulbs, knives, and so on. All guards were instructed to report immediately any depression or change of attitude on the part of a prisoner. It was recognized, however, that if a man wanted to die he could not be prevented from doing so regardless of all the precautions taken. Anyone who handles unstable patients knows that he is going to have some mortality sometime.

Example.—R. A., S2c, who revealed a poor preservice and service record, warned the members of the deck court that he would commit suicide if sentenced. Back in his cell he swallowed an open safety pin which perforated his esophagus resulting in a mediastinitis. It was only through heroic measures that this man's life was saved.

MISCELLANEOUS OFFENSES

Offenders with organic brain damage were seen regularly. The careful study of these men included neurological and psychometric investigations. Some sequelae of meningitis were seen which were ample reason for untoward behavior resulting in disciplinary infraction. Head injuries always warranted intense study.

Example.—R. T. W., Pvt. U. S. M. C., sustained a severe temporo-parietal lesion, the result of a gunshot wound. This examiner considered that this man had sufficient organic brain damage with resulting personality changes to cause his untoward behavior.

UNUSUAL CASES

There were cases which held more humor than pathos. A marine was seen who went AWOL for 5 years because he was "bawled out" by his sergeant. A Navy Man was AOL for 3 years and was found

hauling vegetables to a naval base. He stated that he considered that occupation as patriotic as his former one. One offender drove a Navy bus for a year before being picked up. Another worked with the FBI for 11 months before his finger prints caught up with him through the efforts of the FBI. Several offenders joined the Army or the merchant marine. One prisoner won \$25,000 in a dice game and when compelled to pay \$14,000 in taxes, went "over the hill." Another offender during his AOL period worked as a civilian brick-layer constructing the brig in which he was eventually housed. Another was found to have a small printing press on which he turned out amazingly accurate liberty cards and leave papers which he sold at fancy prices. He was picked up when the authenticity of his official liberty card was questioned.

CONCLUSIONS

A suggested plan, then, for the disposition of disciplinary cases which have some psychiatric condition is presented: (a) A true and accurate determination of the facts of the violations of regulations, with particular attention paid to determining whether there was present an element of criminality against the person or property of others; (b) if no criminality is involved and the individual is found to be suffering from a psychiatric disorder, this person should, in my opinion, be given a special order discharge as soon as possible; (c) however, if criminality is found to exist, the case should be tried and prior to sentencing, a board consisting of at least one psychiatrist should make a recommendation as to whether the sentence should be carried out in a naval prison or in an institution for the criminal insane.

Traditionally, there will be some opposition to the special order discharge of individuals who have had disciplinary charges brought against them, as the feeling exists in some lay and professional quarters that prisoners receiving such a discharge are "getting away with something." Whether punishment should or should not be avoided is not the important point here. The question to be decided is whether punishment and disciplinary action will be of any value to this man, the Navy, or to his home community later. The type of individual who reacts well to naval discipline and punishment is no different from the individual who reacts well to civil discipline and punishment. The efficiency of the disciplinary programs in the military services is deservedly high, but no amount of any type of discipline or punishment can effectively act as a corrective when there is not present a sense of responsibility, an ability to learn by experience, or a desire for future security. It is absurd to expect men to make a proper military adjustment when they have been unable to adjust to previous civil and legal disciplinary actions. If repeated punishment in the past has failed to

correct a chronic delinquent, it is scarcely to be expected that disciplinary effort, time, and expense expended during a national emergency will be successful.

It should not be forgotten that the code of the Navy presupposes honesty and honor which affords a year-around opportunity for crime on the part of the naval personnel who lack these attributes. It is important, especially now with the new type of recruit, that the percentage of repetition of crimes might be more acute.

The problem of delinquency in the naval service is one which merits much thorough and intensive study, for knowledge of the psychodynamics of the personality of the naval delinquent can provide a basis for the rational approach to his reeducation and orientation as well as aid greatly in determining the direction of a successful program of therapy.

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AN EVALUATION OF A PHYSICAL TRAINING PROGRAM AT A NAVAL AIR STATION

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The duties of a naval flight surgeon, like naval aviation, are continuously and progressively expanding. The flight surgeon has become an important member of the Aviation Safety Board and has recently been included in the Aviation Survival Program. There is much in common in these programs since the ultimate aim is the prevention of aircraft accidents, the conservation of life of those participating in flying, and to promote, protect, and maintain medical safety in aviation.

In carrying out a successful aviation emergency survival program the information and training has been divided among the following personnel: Survival officer, physical training officer, medical officer, air combat intelligence officer, aviation equipment officer, and flight officer. Thus, each phase of survival training is taken up by one who is conversant in his own particular field. The medical officer has charge of the instruction and supervision of the physiological and medical aspects of survival and related equipment.

At a naval air station, located in central Pennsylvania, a carrier air photographic reconnaissance training school was based. The athletic and recreational program was inclusive and the personnel participating in it consisted of officers (staff), student officers (naval aviators), and enlisted men. The type of exercise was varied, competitive, and recreational and left to the choice of the individual, depending on circumstances. The officers had complete freedom of selection. The enlisted men were given a choice of certain group games and such sports as organized athletics under supervision. The program was compulsory for all, and a minimum of 4 hours a week was required. The program was not overstrict, nor was it as strenuous as was the physical training previously taken by these same naval aviators at preflight schools. A list of the games and sports offered is as follows: Badminton, ping-pong, horseshoes, boxing (punching bag), softball, volleyball, skeet, horseback riding, tennis, golf, fishing, and swimming. The swimming was part of the ac-

cepted survival training including instruction, tests, first aid, and demonstration of the Eve's method of resuscitation as adopted by the U. S. Coast Guard.

Based on the assumption that the better one could physically qualify and then maintain good health, the better able he would be to withstand and undergo the vicissitudes and ordeals attendant with forced landings prior to rescue. Thus the pilot and air crewmen would have more of a chance of coming through alive. Both Stefansson and Ellsworth (1) stress the importance of careful check-up of details and thorough preparation before the actual expedition or exploration. The survival program takes cognizance of this also. Physical training along with adequate medical care is an effort toward the maintenance of maximum physical and psychological fitness of personnel.

Although the possibility was not likely that any single individual would be subjected to the rigors of such a hardship, nevertheless, it is believed that good physical condition is of intrinsic value. It was believed that more tangible benefits to the participants would be improvement of health, endurance, and well-being soon after the program was instituted. That this was definitely correct was evidenced by better posture, improved morale, and the attendant jocularity and rivalry during participation in games.

The physical training officer was designated to have the over-all supervision of carrying out the Survival Program. In conjunction with this officer the writer proposed that at the time of the inception of the program all personnel be required to undergo a physical examination and a physical record be kept. This form was provided for each man (officer and enlisted) and completed. It included the age, height, weight, measurements (chest and abdomen), posture, blood pressure, and heart and chest examination of the applicant. Six months later a duplicate record was completed. A comparison of the physical findings was then made and certain arbitrary figures were evaluated and determined, based on Navy physical requirements, Standards for Height, Weight, and Chest Measurements (article 1442, Manual of the Medical Department, U. S. Navy, 1944), Physical Requirements for Aviation Personnel, and the film "Specific Gravity of the Healthy Man."

RESULTS

Since personnel is continually changing within naval commands, many (66) of the men examined at the beginning of the plan were transferred to other activities. The statistical data are based on those who were available for the second physical check-up after 6 months.

An analysis of the age, height, and weight measurements, and chest expansion in the cases of 196 men showed:

- A. In the age groups 17-25 there was 48 percent; 25-35, 45 percent; and 35-43, 7 percent.
- B. In the overweight group there was 71 percent; in the normal weight group, 26 percent; and in the underweight group, 3 percent.

Fifty-two percent in the overweight group lost weight ranging from 1 to 24 pounds, with an average of 8 pounds. Harris (3) states that the age group 25-35 is that in which most can be accomplished in the way of prophylaxis and fitness. Overweight is probably the most common defect encountered in this group.

- C. Of the entire number of participants examined, 26 percent were considered normal prior to the installation of the program. Six months later 35 percent of the participants were classified in the normal group. This represented a gain of 9 percent.
- D. An increase in the chest expansion measurements showed a gain of 54 percent.
- E. Abdomen measurements revealed a loss in 35 percent of the cases and a gain in 30 percent of the cases. However, losses of 1 to 3 inches were frequent whereas, the usual increase in the abdomen measurements was $\frac{1}{2}$ and 1 inch.

COMMENT

The height and weight measurement figures were those used in aviation physical requirement tables. They stress the lean, athletic type. An arbitrarily normal range was set up between 25 pounds above and 15 pounds below the weight figure given in those tables. Therefore, an applicant weighing more than 20 pounds above this figure was considered overweight. Similarly, one more than 15 pounds below this figure was classified as underweight. The chest and abdomen measurements and relation to each other were referred to tables on the study of specific gravity of healthy men. A difference of less than 5 inches between the abdomen and chest measurements at rest was taken as an indication toward obesity. An applicant with a systolic blood pressure of 140 or more was considered in the hypertension group; if 100 or less he was classified under the hypotension group. The actual requirements as suggested by the writer were more liberal than those limits used in aviation medicine, being 136 and 105, respectively. However, the standards were arbitrarily determined based on the reference sources named.

No attempt had been made to evaluate such factors as diet, smoking, and temperature (climate) and their effect on the participants in this athletic, recreational program during the 6-month period (April

to October). At the time of presentation of the program the medical officer outlined to the men the principles of physical education and training. Although no comparison was made of the amount of smoking by the participants before and after the program, it is interesting to note that 13 percent were classified as confirmed smokers (1½ packages of cigarettes a day or 5 or more cigars); 65 percent were moderate smokers (1 package of cigarettes per day or 4 cigars), and 22 percent were occasional or nonsmokers. Ninety-three percent of the examinees belonged to the younger age group, yet their smoking habits were already well established. No evaluation of the blood pressure readings was made since there are so many extraneous influencing factors.

CONCLUSIONS

Certain conclusions have been drawn as a result of close observation of this physical fitness plan.

1. Improvement of morale was an outstanding observation.
2. There was a definite improvement, approximately 50 percent, in the physical fitness with an approach to the "norm" (previously but arbitrarily decided upon) following participation in an extensive physical program.
3. Better posture and attendant military bearing was noticed, especially at personnel inspections by higher echelon officers.
4. There was an increased number of traumatic cases following injury directly attributable to the program. These included contusions, sprains, and fractures. It was the universal consensus that the program was worthwhile, notwithstanding that an objection based on increased morbidity might be raised.
5. A number of men having had a previous operation for dislocation, articular cartilage, knee, were unable to carry on an increased physical exercise because of exacerbations of symptoms.

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IMMUNOLOGY OF TULAREMIA

While intravenous injection of *Pasteurella tularensis* into rabbits results in the death of the animals; intradermal injections of sublethal doses of live cultures increased the resistance of the animal to the corresponding strain.—KHATENEVER, L. M.: Immunology of tularemia. III. IV. V. Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow) 1943 (7/8): 36-44, 1943; Biol. Abstr. 20: 941, May 1946.



VACCINOTHERAPY OF CUTANEOUS LEISHMANIASIS

"Vaccinotherapy, mainly when used in combination with other treatments, gave good results in skin leishmaniasis. The cosmetic effect was also satisfactory. The dosage of the vaccine has to be individualized. The treatment could be carried out on outpatients, because the reactions were mild. Five case histories are given."—DUBOVSKII, P. A. (Med. Inst. Turkmenia.): Meditsinskaja Parazitologiya i Parazitarnye Bolezni (Med. Parasitol, and Parasitic Dis.) 11 (1/2): 67-74, 1942; Biol. Abstr. 20: 572, March 1946.

OBSERVATIONS ON THE PRODUCTION OF HYDROGEN SULFIDE BY SHIGELLA ALKALESCENS

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In a recent note Galton and Hess¹ state that in a series of 232 strains of *Shigella alkalescens* isolated in Florida during 1945 only 5 formed H₂S in Kligler's iron agar. The appearance of H₂S was delayed for 48 to 72 hours, the last 24 being under incubation at room temperature. It was stated further that one investigator has encountered no alkalescens cultures that produced H₂S. In conclusion, Galton and Hess comment on the ability of some strains of *Shigella alkalescens* to form H₂S in large amounts and note that such strains apparently do not lose this characteristic.

During the past 3 years, while attached to the Enteric Pathogen Laboratory at the U. S. Naval Medical School, the authors made observations on strains of *Shigella alkalescens* isolated from patients and asymptomatic subjects who were stationed in various geographic areas. It appeared worthwhile to assemble the results of the routine tests for H₂S that had been made on these cultures and to repeat the tests on those strains that had been preserved in stock.

In all, 166 cultures isolated from 141 individuals were listed; of these, 95 cultures from 89 individuals were available for reexamination. All strains conformed biochemically and serologically to the characteristics of *Shigella alkalescens* although tests were not made for antigens A, B, C, and D. The lead acetate paper method for detecting H₂S formation in 2 percent peptone solution was used throughout and incubation was at 37° C. for a minimum of 4 days in instances of negative findings.

The cultures preserved had been kept in agar stabs in paraffined cork stoppered tubes for an average of 17.9 months, the range being from 6 to 38 months. The results of the initial tests showed that 33

¹ GALTON, M. M., and HESS, M. E.: Hydrogen sulfide formation by *Shigella alkalescens*, J. Bact. 52: 143, July 1946.

strains were negative ($-$), 8 were doubtful (\pm), and 54 were recorded as positive (+ to +++) producers of H_2S . Upon retesting, the 95 strains fell into 1 to 4 broad categories insofar as change in results was concerned:

(a) Six (6.32 percent), doubtful. Of these, one was \pm initially and $-$ on retest; one was $-$ at first and \pm at the second test; and four changed from \pm to +. The average interval between tests in this group was 20.7 months, with the minimum and maximum of 14 and 36 months respectively.

(b) Two (2.10 percent), changed from positive to negative. Both of these cultures gave weak initial tests (+); the interval between tests was 16 months for one strain and 18 months for the other.

(c) Twenty-eight changed from negative to positive ($-$ to +, ++, +++, or +++++), three changed from doubtful (\pm) to strong positive (+++ or +++++). The average interval between tests was 19.1 months while the range was 8 to 38 months. This group represents 32.63 percent of the total.

(d) Fifty-six (58.95 percent), no change. Of these, 4 strains were negative in both tests; the balance of 52 strains was positive both times and varied in intensity from + to +++++. The average interval between tests was 16.9 months and the range was 6 to 31 months.

Seventy-one cultures isolated from 52 individuals had not been preserved and consequently only the initial results can be reported. These strains were grouped into 3 categories as follows:

- (a) Twenty-eight (39.43 percent), negative.
- (b) Five (7.04 percent), doubtful.
- (c) Thirty-eight (53.52 percent), positive.

When the initial tests alone are considered, the total of 166 strains becomes grouped as follows:

- (a) Sixty-one (36.75 percent), negative.
- (b) Thirteen (7.83 percent), doubtful.
- (c) Ninety-two (55.42 percent), positive.

Of some interest are the results from replicate cultures isolated from 17 different individuals. The numbers are: 13 subjects, 2 cultures each; two individuals, 3 cultures each; and two other subjects, 5 cultures each. In some instances, the replicates represented 2 transfers made from the same isolate; in others, different colonies from the same isolating medium; and in still others, cultures taken from the individual at different times. Of 16 cultures showing no difference in H_2S formation and taken from 8 subjects, both strains were negative in 3 instances, both were positive in 5 cases, and in 1 set of duplicates both showed a change from negative to positive between

the first and second tests. From 4 other subjects, duplicate cultures showing differences were distributed as follows: 2 subjects, 1 culture each exhibited no change, and 1 culture each changed from negative to positive; 2 subjects, 1 culture each was negative and 1 each positive on initial tests. Triplicate cultures were isolated from 2 different subjects; from 1 individual, 2 strains were negative and 1 positive, while from the other subject 1 culture was positive but the other 2 doubtful. Five cultures each were isolated from 2 subjects; in 1 instance, 3 cultures were positive, 1 was doubtful and the other negative; in the other case, 3 strains were positive and 2 were negative.

In summary, the observations described herein confirm the report of Galton and Hess that some strains of *Shigella alkalescens* form large amounts of hydrogen sulfide. In this series of cultures, over one-half were capable of this activity. The majority of changes noted upon repeat tests were from negative to positive since 31 strains fell into this category while only 2 cultures exhibited a change from weak positive to negative. It appears justifiable to conclude that formation of H₂S by *Shigella alkalescens* conforms to the bacteriologic adage that a highly constant feature is variability.



COMPARATIVE STUDY OF EFFICIENCY OF VACCINES IN TULAREMIA

In experiments with guinea pigs, not a single killed vaccine was found to induce active immunity against tularemia. Immunization with a live, avirulent culture protected most animals for about 3 months.—VERENIMOVA, N. K., DENISENKO, L. K., and KONTORINA, A. A.: Zhurnal Mikrobiologii, Epidemiologii i Immunobiologii (Moscow) 1943 (7/8) : 32-35, 1943; Biol. Abstr. 25: 941, May 1946.

ARMY-NAVY MEDICAL MATÉRIEL COORDINATION

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In November 1944 the Secretary of the Navy and the Under Secretary of War directed the preparation of reports by the various Bureaus and Services to determine to what extent procurement of matériel by the War and Navy Departments could be further coordinated so as to meet their needs with greater efficiency and more economical use of resources and public funds. The Medical Departments of the Army and Navy submitted a preliminary report showing the need for closer coordination although there was already a considerable degree of coordination, cooperation, and mutual assistance. Subsequent reports recommended the joint procurement of medical matériel. It was emphasized in these reports that the practice of medicine was essentially the same by the two Departments and that the matériel required was, to a great extent, identical. That there would be many advantages, both to the Government and industry, as a result of a coordinated medical matériel procurement program was also emphasized.

The advantages to the Government in establishing a joint procurement agency would be: (1) a decrease in operation overhead by reduction in manpower, cost, and time consumed; (2) elimination of competition between the two services; (3) uniform supplies acceptable to both organizations; (4) conservation of raw material; (5) centralized control over production facilities; (6) more efficient use of production facilities with consequent release of production capacity for other uses; (7) a reduction in price with volume buying; (8) a decrease in surplus matériel by interchangeability of stocks; (9) better design and development of equipment; and (10) facilitation of stock exchange between the services.

The advantages to industry from the establishment of such an agency would be: (1) standardization of policies and procedures; (2) elimination of duplicate forms and pricing data; (3) a decrease in tooling costs and elimination of duplicate production lines by uniform specifications; and (4) uniform inspection standards and procedures.

Although no disadvantages of joint medical procurement were reported, numerous obstacles were predicted. Many of these were due

to the separate administrative organizations of the two services, others to the great differences existing in catalogs and specifications, and the greatest of all was the war. The Medical Department of the Army and the Bureau of Medicine and Surgery of the Navy were then engaged in the greatest medical supply programs ever undertaken. No interruption in the flow of vast quantities of medical matériel to the war fronts could be permitted.

A joint agency was established early in 1945 with Rear Admiral K. C. Melhorn (MC) U. S. N., as director and Brig. Gen. Edward Reynolds (MAC) U. S. A., as deputy director, for the preparation and submission of plans to implement the recommendation for the joint procurement of all medical and surgical equipment and supplies. Detailed plans were submitted by this agency in June and July 1945 to the Surgeons General and on 15 December 1945 the Army-Navy Medical Procurement Office was established by the Secretary of War and the Assistant Secretary of the Navy. The agency continues to operate under the Surgeons General and the Munitions Board in formulating policies.¹

The Army-Navy Medical Procurement Office as now organized has six divisions. The commanding officer is from one service and the executive officer from the opposite service.

MATÉRIEL STANDARDS DIVISION

The Matériel Standards Division was established upon the activation of the joint office to coordinate and supervise the work of the Catalog, Specifications, and Laboratory Branches.

CATALOG BRANCH

The Catalog Branch was established on 14 June 1945 to maintain Army and Navy medical supply catalogs and to develop and issue a new Navy Medical Supply Catalog. While awaiting formal approval of the operating plan submitted in March 1945 the Army Medical Catalog Branch was transferred from the Office of the Surgeon General, Washington, D. C., to the Army Medical Purchasing Office, New York City. Concurrently, the Navy Medical Department Catalog Branch was transferred from Brooklyn to the same address. Careful consideration in the initial studies was exercised in determining a common system of stock numbers, nomenclature, classes to which items would be assigned, and other catalog features. The numbering systems of the Federal Stock Catalog, a proposed ASF system, and an expected new Federal numbering system were among those considered. Modifi-

¹The organization chart appears on page 568. This chart was received from the author after the pages were made up and it was necessary to place it in the back of the BULLETIN.

cation of the present Army Medical Supply Catalog system was found to be the most desirable.

In August 1945 the Army-Navy Medical Matériel and Specifications Board was established for coordinating the determination of military characteristics of Medical Department items required in common by the Army and Navy. This board consists of officers representing the various services and divisions of both Medical Departments. Item review teams, as working sub-committees for the Board, were appointed by and made representatives of the Surgeons General. The members of the item review teams were specialists in the respective classes of matériel. These teams made a comprehensive review of some 10,000 items cataloged by the Medical Departments of the Army and Navy. The investigation and resolving of these items into common items required 8 months and was completed in March 1946. Upon the completion of this project the teams were disbanded. As a result of this review, approximately 4,500 items were adopted for use by both services; some 2,000 items were declared as no longer required and the remaining items were approved for use by the individual services. The Veterinary Class, for example, is used by the Army only. The Navy Catalog, released subsequent to this review, contains over 90 percent common items. An Army-Navy Catalog of Medical Matériel is now being developed and will be published in the near future. It will be similar in format to the present Navy Catalog. The joint catalog now consists of files listing the items used by both services, all of which are cataloged in the same system.

SPECIFICATIONS BRANCH

The Specifications Branch was established on 21 July 1945 with authority for the preparation and modification of specifications, upon the direction of the Army-Navy Medical Matériel and Specifications Board. Its first task was to furnish specification data on Army and Navy items to the item review teams for investigation. Meanwhile, separate purchase descriptions were prepared for current procurement by the Army and Navy. (A purchase description is an abbreviated specification, referencing JAN Specifications, Federal Specifications, Army or Navy Specifications, and in some instances commercial catalog listings, for the use of the Procurement Division.)

The preparation of joint purchase descriptions began after items reviewed by the teams of specialists and approved by the Army-Navy Medical Matériel and Specifications Board were catalogued and assigned joint Army-Navy stock numbers, nomenclature, and units of issue. By July 1946 the task was largely completed when approximately 6,000 purchase descriptions had been prepared and distributed.

At the time a purchase is initiated, the purchase description to be used is reviewed by medical officers of the Matériel Division of the Bureau of Medicine and Surgery acting for the Army-Navy Medical Matériel and Specifications Board. This review will go a long way in assuring that the material specified possesses the necessary professional as well as technical characteristics. At this time the specifications are carefully reviewed to eliminate war substitute materials and obtain the best materials now available. Specifications and purchase descriptions are continually revised to obtain the benefits of new and improved materials.

Along with the preparation of purchase descriptions, the Specifications Branch prepares drafts of proposed Federal Specifications or Joint Army-Navy Specifications from the existing Army and Navy Medical Department Specifications. A program has been started to convert existing specifications into Federal or JAN specifications by December 1950.

LABORATORY BRANCH

The Laboratory Branch was established with the Joint Office on 15 December 1945. The inspection and laboratory functions in the Army were previously carried on by the Field Service and Laboratory Branches of the Matériel Standards Division, Army Medical Purchasing Office. In the Navy, these functions were performed by the Inspection Section of the Procurement Branch, Matériel Division, Bureau of Medicine and Surgery, located at the Naval Medical Supply Depot, Brooklyn. The Navy inspected matériel after receipt in medical supply depots, while the Army through its field inspectors examined matériel at the manufacturer's plants and forwarded samples to the laboratory. Since inspection at source provides for earlier release of matériel and more rigid quality control, it was adopted for the Joint Inspection and Laboratory Branch. It is interesting to note that the policy of source inspection in the Medical Departments was the reverse of that which obtained throughout the services, where the Navy followed the policy of inspection at source and the Army policy was that of inspection after delivery. During the first 6 months the laboratories continued to operate separately. During this period the work was routed to the laboratory which could best handle the particular type of examination required. Since 15 June 1946, the laboratories have been physically consolidated at 52 Broadway, New York City.

The primary function of this Branch is the quality control of medical and surgical supplies and equipment to provide the Army and Navy Medical Departments with the high quality matériel required by the specifications. Quality control starts at the manufacturer's

plant where field inspectors examine the matériel on the production line. Samples required are selected and forwarded to the laboratory where highly trained specialists perform detailed analyses before the matériel is released from the contractor's plant. The depots are also issued instructions to check all shipments for evidence of damage in shipment, fraud, or substitution. The laboratory also maintains a sample room where most of the standard catalog items are on display.

On 10 June 1946 the Surgeons General, upon consideration of a detailed report submitted by the Material Division, Office of the Assistant Secretary of the Navy, approved the use of the field inspection facilities of the Material Inspection Service, U. S. N., by the Army-Navy Medical Procurement Office. On 1 September, field inspection for the Army-Navy Medical Procurement Office was transferred to the Material Inspection Service, U. S. N. Samples requiring technical laboratory examination are selected at the manufacturer's plant and forwarded to the Laboratory Branch, Army-Navy Medical Procurement Office by the inspectors of naval material. In certain cases, the naval inspectors will perform complete inspection at the manufacturer's plant. Payment for the services rendered by the Material Inspection Service will be borne proportionately by the Army and Navy Medical Departments.

PURCHASES DIVISION

The Purchases Division was established upon the activation of ANMPO with authority to negotiate, prepare, and execute all contracts on centrally procured medical matériel for the Army and Navy. These functions were previously discharged for the Army by the Purchases Division of the Army Medical Purchasing Office, 52 Broadway, New York City; and for the Navy by the Matériel Division, Bureau of Medicine and Surgery located at the Naval Medical Supply Depot, Brooklyn, N. Y., in conjunction with the Navy Purchasing Office of the Bureau of Supplies and Accounts at 90 Church Street, New York City. Concurrently with the transfer of functions from these three organizations, key personnel were transferred to the new activity. Complete integration of the medical purchasing functions of the two services into a single purchasing agency was thereby effected.

In the reports leading to the establishment of the joint purchasing office it had been shown that the differences in the existing Army and Navy purchasing procedures and policies were relatively minor and could be resolved without difficulty.

Complete integration of the medical purchasing functions of the two services into a single purchasing agency, jointly staffed and administered was recommended as having many advantages over looser

TYPES OF COORDINATED PROCUREMENT

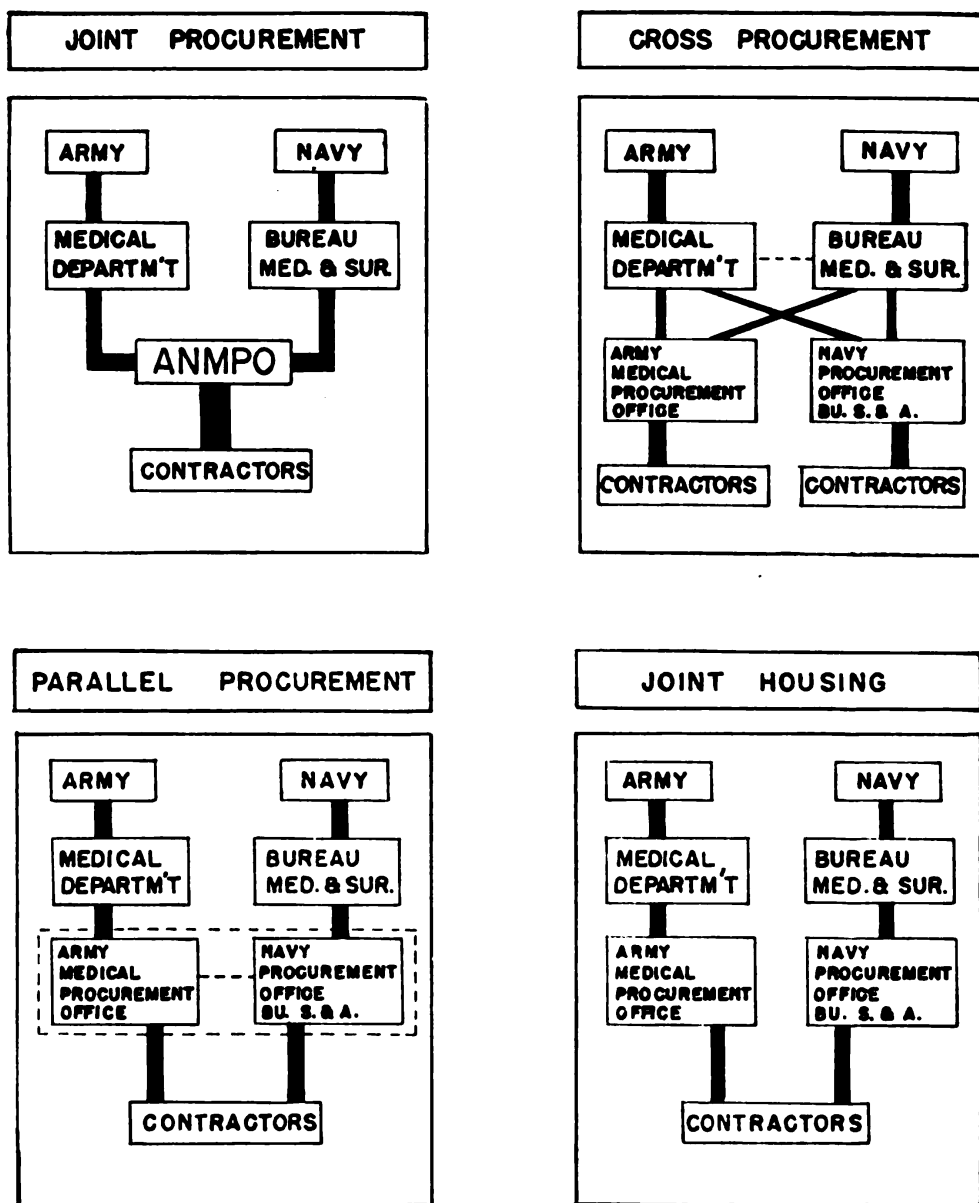


FIGURE 1.

forms of coordination or concentration of all purchasing in a single service. To permit the joint purchasing agency to function on the basis indicated, it was necessary that there be established and maintained a single purchasing plan supplanting existing Army and Navy purchasing policies insofar as there was any conflict between them. A single purchasing plan for the joint agency was submitted and with it, detailed procedures for the accomplishment of joint purchasing.

These were designed embracing the best features then employed by the three agencies. Procurement is now effected on a uniform contract, uniform specifications, and uniform bid proposals, thereby eliminating the former duplication of forms and procedures with their resultant confusion to industry.

Alternatives to consolidated procurement were considered in the preliminary reports. Principal among these were: (a) cross or single service procurement; (b) parallel procurement; and (c) joint housing (see fig. 1).

a. Cross or single service procurement.—Under this plan complete responsibility for the procurement of a common item or group of items would be assigned to a single service. Such a program would necessitate both services becoming acquainted with all the details of clerical forms, procedures, and methods in operation in the opposite service thereby causing substantial confusion and producing few material benefits other than the elimination of competition between the services for similar matériel.

b. Parallel procurement.—Truly parallel procurement would involve the adoption of identical procedural systems for both services and the establishment of identical but separate organizations, jointly housed for the discharge of their respective procurement obligations. To effect such a result would require the adaptation of the operations of both services to a third system considered most ideal. No lasting advantages commensurate with the effort that would be so involved were apparent. If the complete uniformity of operations necessary for parallel procurement could be achieved and a single procurement plan adopted, there was no valid reason apparent why the additional step of merging the two organizations should not be taken since such a move would undoubtedly offer advantages in the economy of personnel and efficiency of operation that would follow from centralized responsibility for all procurement.

c. Joint housing.—This plan contemplated the removal to a single building of all purchasing operations of the two services. Such a removal presented no benefit that could not be obtained by the informal coordination then existing among the three units.

Procurement is initiated by the Requirements Units of the individual services. Buyers accomplish and administer the program so directed. Every effort is made to utilize surplus matériel and a considerable percentage of current procurement is met by interservice transfers. To assist the buyers in their technical problems, close cooperation is maintained with the technical engineers of the Laboratory and Specifications Branches. This aids in solving problems wherein prospective contractors misunderstand specifications, recommend technical changes in specifications, or offer substitute matériel. Wherever possible, one contract is entered into covering requirements for both

services. This is effected by the synchronized issuance of procurement directives for Army and Navy requirements of common items. However, in some instances a single service will develop an emergency requirement which will have to be contracted for on a unilateral basis. The possibility of jointly housing the requirements organizations of the two services is now under consideration.

ADMINISTRATIVE DIVISION

The Administrative Division was established during the development of procedural details for the Army-Navy Medical Procurement Office after its activation. It consists of the Fiscal, Transportation, Office Service, Military Personnel, and Civilian Personnel Branches, which were approved as Branches. Except for the Fiscal Branch, all of these operate much as they did previously under separate commands.

FISCAL BRANCH

In view of the fact that there is no existing appropriation for the joint office, the available appropriations of both services must be utilized to the extent necessary in discharging the fiscal requirements of the joint operation. In the disbursement of funds for medical stores, contracts issued are charged against the working funds of the service concerned depending upon the source of requirements for each contract. Expenditures for office maintenance and supplies including the salaries of civilian employees are paid from Army funds so that in the case of office equipment and similar matériel, accountability problems will not be created which might otherwise result if two appropriations were employed. Reimbursement for a proportionate share of operational expense is made by the Navy.

MANAGEMENT ENGINEERING OFFICE

The Management Engineering Office constantly reviews the existing organization to evaluate the effectiveness with which assigned responsibilities are being carried out and to measure the progress of the joint office in the performance of its mission. As the result of this review it makes recommendations regarding organizational changes, assignments of functions, operating methods, procedures, and institution of controls to assure the highest degree of performance. This office also prepares detailed instructions and charts for the Army-Navy Medical Procurement Office Manual.

LEGAL OFFICE

This office acts as general legal counsel to interpret the legal implications of regulations and directives issued by higher authority. This

office reviews contracts and modifications to determine their compliance with current policies and regulations prior to release. It also reviews and investigates claims by and against the Government, applications to correct errors in contracts, and applications for relief from hardship.

ORIGINAL JOINT ACTIVITY

The Matériel Standards Division, Purchases Division, Administrative Division, Management Engineering Office and Legal Office comprise the joint activity as originally established on 15 December 1945. Since that time additional studies have resulted in further coordination and the establishment of three additional divisions as part of the Army-Navy Medical Procurement Office.

MEDICAL TECHNICAL MAINTENANCE DIVISION

In March 1946 a memorandum submitted by the Army-Navy Medical Procurement Agency to the Under Secretary of War and the Assistant Secretary of Navy through the Surgeons General, was approved for the establishment within the Army-Navy Medical Procurement Office of a Medical Technical Maintenance Division with authority to formulate policies, plans, and procedures regarding technical supervision of maintenance and repair activities of the Army and Navy Medical Departments. The Medical Technical Maintenance Division is composed of the Shops Branch, Publications and Requirements Branch, and Operations and Training Branch.

SHOPS BRANCH

The Shops Branch maintains staff and technical supervision over all Army and Navy medical maintenance and repair shop activities utilizing existing maintenance and repair facilities of both services. This Branch initiates and disseminates maintenance and repair policy, and reviews reports received from repair activities. Current data on personnel utilized, equipment used, material received and repaired, working standards and hazards, job improvement studies and methods, repair cost analyses, civilian repair facilities used, and other pertinent data are also maintained by this Branch. Consideration is being given to the establishment of joint Army-Navy repair facilities.

PUBLICATIONS AND REQUIREMENTS BRANCH

The Publications and Requirements Branch plans and is responsible for the preparation of medical technical maintenance publications, such as the joint Army-Navy Spare Parts Catalog, Operating and Maintenance Manuals, and Modification Work Orders. This Branch determines initial procurement requirements for spare parts

of Army-Navy medical technical equipment and makes recommendations relative to inventory control and storage of spare parts. The preparation of the joint Army-Navy Spare Parts Catalog is progressing and it is hoped that some pamphlets will be ready for distribution in the near future to Army and Navy activities. It is planned to distribute individual illustrated pamphlets cataloging spare parts for each model of technical equipment used. Priority is being given to cataloging spare parts of equipment that will be used in theaters of operation.

OPERATIONS AND TRAINING BRANCH

The Operations and Training Branch maintains staff supervision and implements all Army and Navy medical maintenance and repair training activities including the joint Army-Navy Medical Equipment Maintenance Course at St. Louis Medical Depot, St. Louis, Mo. inaugurated in November 1946. The first class will graduate in May 1947. Succeeding classes will be enrolled approximately every 6 months thereafter. The course consists of practical and theoretical training in the maintenance and repair of medical technical equipment used by the Army and Navy.

ENGINEERING DEVELOPMENT DIVISION

In May 1946 the Assistant Secretary of Navy and the Under Secretary of War, upon consideration of a memorandum submitted by the Army-Navy Medical Procurement Agency, approved the establishment of an Engineering Development Division within the Army-Navy Medical Procurement Office. This Division is to (1) plan and execute the development of projects as directed by the Army Medical Research and Development Board and/or Research and Matériel Divisions, Bureau of Medicine and Surgery, and the Navy Medical Matériel Board, singly or jointly through the Army-Navy Medical Matériel and Specifications Board; (2) investigate failures in existing matériel and institute measures for correction; and (3) coordinate industrial development of medical matériel with that of the Army and Navy Medical Departments. No basic research is to be performed by this group. It will ordinarily utilize information already available in solving assigned projects. The functions of this division were formerly scattered through various facilities of the Army and Navy Medical Departments and were never placed on a centrally organized basis except for the Army Medical Department equipment laboratory at Carlisle, Pa., which was interested largely in the development of field items. The Division consists of a Chemical Engineering Branch, an Electrical Engineering Branch, a Mechanical Engineering Branch, and a Laboratory and Shop Branch. The latter is the

former Army Medical Department equipment laboratory still located at Carlisle Barracks, Pa. This Branch will be moved to New York in the near future.

In the development of new items, engineering studies are made of the military characteristics required of proposed items referred through the Army-Navy Medical Matériel and Specifications Board and the engineering design and physical development of such articles are effected in coordination with industry. Trial models are submitted for field testing and defects disclosed by testing are corrected. After final acceptance, a draft of engineering specification data is prepared. Standard items reported unsatisfactory are studied and necessary measures for correction are instituted. Recently, the policy has been established to examine from depot stocks at periodic intervals, all items known to deteriorate within a reasonable time. Contact with industry is being established and maintained to keep abreast of industrial developments of interest to the Medical Departments.

INDUSTRIAL MOBILIZATION AND PROCUREMENT PLANNING DIVISION

This Division was established early in January 1947 as a functioning unit of the ANMPO by the Under Secretary of War and the Assistant Secretary of the Navy upon a recommendation of the Army and Navy Munitions Board. The functions of this division will be to determine the over-all capacity of industry to produce the medical matériel required for mobilization and to make recommendations for the allocation of industrial facilities to the armed forces, in the event of mobilization.

Detailed plans are now being formulated to implement this program. It will be necessary to compile detailed lists of matériel required by the two services and to survey the facilities of industry to produce this matériel. The Naval Material Inspection Service will be utilized to make industrial surveys.

PARTICIPATION OF RELATED GOVERNMENT AGENCIES

The U. S. Public Health Service has within the past month decided to procure medical supplies through the Joint Office. Detailed procedures to accomplish this program have been established.

The Veterans' Administration now utilizes only the facilities of the Catalog Branch and the Laboratory Branch. Studies now in progress may lead to further participation of this agency in the Joint Office.

The participation of these agencies in the joint operation was not anticipated in the preliminary studies of coordinating Medical Ma-

tériel Procurement in the armed forces. The advantages of assembling the Medical Matériel Procurement functions of the Federal Government in a single agency are self-evident.

TASKS AHEAD

Three additional phases of coordination are currently under consideration by committees established by the Army-Navy Medical Procurement Agency. Planning of requirements, inventory control, and warehousing are being studied to determine the advisability of further coordination. The integration of these additional units into joint organizations, if determined advisable, would complete the coordination of medical matériel between the two services.

SUMMARY

The Army-Navy Medical Procurement Office has now been in operation over 1 year. At this time it is perhaps premature to draw conclusions; however, from the experience to date, it is possible to summarize and evaluate the operation.

Careful studies by various committees have preceded each step of integrating the medical matériel facilities of the two services. After a year of intensive investigation and deliberate consideration of the numerous problems involved, a functional organization was proposed and detailed procedures were submitted embracing the best features of each service. Only then was the joint office established. Similar studies have prefaced the creation of additional coordinated units.

The office began to function effectively as a joint organization about 6 months after its activation. These early months were spent in establishing the procedures laid down by the preliminary reports, and in the determination of common items upon which the success of joint procurement largely depended. During the second 6 months of operation the advantages claimed for the joint procurement of medical matériel were clearly demonstrated. The 12 months have shown that the joint office is a success.

The coordination of medical matériel represents a very considerable step forward, an evolutionary step on the road to greater efficiency. It does not necessarily mean an immediate budgetary economy which is difficult to appraise under present changing conditions and the increased scope of activities of the new organization. But military effectiveness and not economy alone is the standard upon which this office is to be judged. And the military effectiveness is demonstrated by the large measure in which it has met the advantages claimed.

The success of the joint operation can be attributed, in no small measure, to two factors—the careful studies of the problems involved, and the determination on the part of all concerned to make the project succeed. The accomplishments clearly indicate the perfect accord in which everyone concerned worked to bring into reality the constructive vision of the Surgeons General.



A CRITICAL ANALYSIS OBTAINED FROM 873 ELECTROENCEPHALOGRAPHIC EX- AMINATIONS

RALPH ROSSEN

Lieutenant Commander (MC) U. S. N. R.

The following analysis was undertaken to correlate and evaluate the admission diagnoses, the discharge diagnoses, and the EEG findings in a group of neuropsychiatric patients studied at a United States naval hospital. It was frequently noted that there was a marked discrepancy between the admission diagnosis and the discharge diagnosis which in turn was prone to reflect on the EEG interpretation, especially when the latter was subjected to careful statistical criteria. It was therefore felt that a careful follow-up in regard to final disposition of some of these cases might disclose additional clinical information which would give a much more accurate picture of the relationship of the EEG findings to various clinical entities besides and including the convulsive disorders. A concrete example of this is as follows: Of 128 patients who were admitted with a diagnosis of epilepsy, 55 percent showed abnormal or slightly abnormal EEG. A careful follow-up of these patients revealed that only 92 of them were discharged from the naval service with the diagnosis of epilepsy and that of this group 75 percent showed abnormal or slightly abnormal EEG. The remaining 36 were discharged with various other diagnoses and showed 39 percent of abnormal or slightly abnormal EEG. In a like manner a total of 873 cases was analyzed as shown in tables 1 through 5. A comparison of the EEG findings was made with a control group (1) and with the EEG findings of other investigators who worked with various clinical entities (2) (3) (4) (8).

In this series personality disorder group included cases of constitutional psychopathic state, emotional instability; constitutional psychopathic state, inadequate personality; constitutional psychopathic inferiority and schizoid personality. When the patient's psychoneurotic condition was complicated and aggravated by environmental situations arising in line of duty but which had been present prior to entering the service the diagnosis used would be psychoneurosis with the proper subgrouping (aggravated by service). When it was established that the individual was in good mental health prior to

entering the service and had developed a psychoneurotic complex while in the naval or marine service the diagnosis of psychoneurosis with the proper subgrouping (line of duty) was established. The symptom complex known as combat or operational fatigue was not used as a discharge diagnosis and when an individual with these symptoms did not recover sufficiently to warrant return to duty he was discharged with the diagnosis of psychoneurosis (with the subgroup listed) and designated as to whether it was line of duty or, if the condition existed prior to his enlistment, aggravated by service. The group discharges with no disease consisted mainly of personnel exhibiting insufficient symptomatology to warrant their being classified as psychoneurotic or having personality disorders yet clearly not adapted to military service. In addition there was a small number who, despite having sufficient symptomatology to render them classifiable as psychoneurotics etc., showed adequate motivation and active desire to remain in service and therefore were returned to duty with the diagnosis of no disease (N. P. obs.). All types of epileptics were discharged with the diagnosis of epilepsy but the specific type of attack was carefully pointed out in the medical survey, e. g., petit mal, grand mal, etc.

TECHNIQUE

The electrical activity of the right and left frontal, parietal, and occipital cortex was recorded with a Grass 6-channel EEG. All records were made with monopolar leads. The indifferent electrode was formed by interconnecting the two ear leads. Electrodes were applied to the scalp using the method described by Gibbs (7). Records were taken with the patient lying on a table in a shielded cage. Cortical activity was recorded for at least 10 minutes on each subject. Two minutes were allowed for hyperventilation and 2 to 3 minutes were allowed for recovery.

METHOD OF INTERPRETATION

Gibbs' classification of EEG records (8) was used throughout with the following modification: all paroxysmal tracings (petit mal, psychomotor, grand mal, spikes and S.2 and F.2 tracings) were classified as abnormal. The F.1 and S.1 tracings were classified as having minimal abnormalities. Minimal abnormalities in the EEG would closely correspond to what Gibbs (9) calls "slightly abnormal." All activity in the range of 8 to 13.5 per second were classified as normal. Brief runs of slow activity in the S.1 and S.2 groups that persisted for less than 15 seconds after cessation of 2 minutes hyperventilation were discounted if the tracing was normal before hyperventilation and if the abnormalities did not again recur

after hyperventilation. All tracings with paroxysmal types of waves were placed in the abnormal group irrespective of whether they occurred before or after hyperventilation. Abnormalities that occurred *during* the period of hyperventilation were not considered unless they were of the "spike and dome" type. It was the author's opinion that complicating artifact due to the deep breathing, body movements, muscle potentials, etc., appeared so often as to make this unreliable especially in the interpretation of fast and "spiky" types of activity. In records of all tracings mention was made as to whether the abnormalities were focal or nonfocal in type. The whole record was carefully reviewed and random wave counts made on at least 40 seconds of record before and after hyperventilation.

MATERIAL

Analysis of 873 cases was made in regard to admission diagnosis, discharge diagnosis, and the EEG findings. A study of the EEG findings in 259 pharmacist's mates in the age group of 18 to 30 years who were not on the sick list and who were attending an independent duty school was made for comparison purposes. These results are reported elsewhere (1).

Some knowledge was had of all the patients' histories at the time of the EEG examination. All the discharged cases reported here (873) were hospitalized at the U. S. Naval Hospital, Portsmouth, Va. from 3 weeks to 3 months and some of the problem cases were studied as long as 6 months. Every attempt was made through thorough physical, psychiatric, neurological, and laboratory examination to rule out the possibility of an organic basis for the patients' complaints. When indicated these included skull x-rays, blood studies, spinal fluid studies, Rorschach tests, neuro-surgical consultation, and visual fields studies. Indications for air studies were left to the neuro-surgical consultant. Final information of the patient's admission and discharge diagnosis was obtained from the patient's health record and medical survey.

All the EEG examinations were performed under the immediate supervision of the medical officer who later interpreted the tracings.

RESULTS

Tables 1 through 5 are self-explanatory.

TABLE 1.—*Correlation of discharge diagnosis and electroencephalographic findings in 873 cases*

Discharge diagnosis	Electroencephalographic findings						
	Number of patients	Abnormal		Minimal		Normal	
		Number	Percent	Number	Percent	Number	Percent
Epilepsy.....	226	113	50.0	45	19.9	68	30.1
Personality disorder.....	310	43	13.9	71	22.9	196	63.2
Psychoneurosis.....	211	45	21.3	31	14.7	135	64.0
Intracranial injury.....	41	13	31.7	9	22.0	19	46.0
Mental deficiency.....	17	3	17.6	5	29.4	9	52.9
Psychoses.....	8	3	37.5	0	0	5	62.5
Narcolepsy.....	7	2	28.6	3	42.9	2	28.6
Fatigue, combat.....	8	2	25.0	2	25.0	4	50.0
No disease.....	23	4	17.4	8	34.8	11	47.8
Migraine.....	4	1	25.0	0	0	3	75.0
Others ¹	18	3	16.7	5	27.8	10	55.6
Total.....	873	232	26.6	179	20.5	462	52.9
Comparison:							
Epilepsy.....	226	113	50.0	45	19.9	68	30.1
All others.....	647	119	18.4	134	20.7	394	60.9

¹ Arteriosclerosis, hypertension, paralysis agitans, chorea, multiple sclerosis, etc.**TABLE 2.**—*Comparison of admission and discharge diagnoses correlated with EEG findings in 273 cases of epilepsy, diagnosis undetermined (epilepsy), and syncope*

	Electroencephalographic findings							
	Patients		Abnormal		Minimal		Normal	
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent
Admission diagnosis: Epilepsy.....	128		55	43.0	28	21.9	45	35.2
Discharged as:								
Epilepsy.....	92	71.9	47	51.1	22	23.9	23	25.0
Otherwise.....	36	28.1	8	22.2	6	16.7	22	61.0
Admission diagnosis: Diagnosis undetermined (epilepsy).....	108		40	37.0	22	21.3	45	41.7
Discharged as:								
Epilepsy.....	75	69.4	39	52.0	11	14.7	25	33.3
Otherwise.....	33	30.6	1	3.0	12	36.4	20	60.6
Admission diagnosis: Syncope.....	37		7	18.9	6	16.2	24	64.9
Discharged as:								
Personality disorder.....	17	45.9	2	11.8	3	17.6	12	70.7
Psychoneurosis.....	9	24.3	4	44.4	0	0	5	55.6
Epilepsy.....	5	13.5	0	0	1	20.0	4	80.0
Otherwise.....	6	16.2	1	16.7	2	33.3	3	50.0

TABLE 3.—*Comparison of admission and discharge diagnoses correlated with EEG findings in 328 cases of narcolepsy, otherwise,¹ diagnosis undetermined (medical observation), diagnosis undetermined (neuropsychiatric observation), etc.*

	Patients		Abnormal		Minimal		Normal	
	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Admission diagnosis: Narcolepsy	8		4	50.0	3	37.5	1	12.5
Discharged as:								
Narcolepsy	4	50.0	2	50.0	2	50.0	0	0
Otherwise	4	50.0	2	50.0	1	25.0	1	25.0
Admission diagnosis: Otherwise ¹	124		28	22.6	23	18.5	73	58.9
Discharged as:								
Epilepsy	12	9.7	5	41.7	4	33.3	3	25.0
Personality disorder	31	25.0	1	3.2	6	18.4	24	77.4
Psychoneurosis	57	46.0	16	28.1	8	14.0	33	57.9
Otherwise ¹	24	19.4	6	25.0	5	20.8	13	54.2
Admission diagnosis: Diagnosis un- determined (medical observation)	66		15	22.7	13	19.7	38	57.6
Discharged as:								
Epilepsy	14	21.2	8	57.1	3	21.4	3	21.4
Personality disorder	34	51.5	6	17.6	8	23.5	20	58.8
Psychoneurosis	14	21.2	1	7.1	2	14.3	11	78.6
Otherwise ¹	4	6.1	0	0	0	0	4	100.0
Admission diagnosis: Diagnosis un- determined (neuropsychiatric ob- servation)	121		25	20.7	27	22.3	69	57.0
Discharged as:								
Epilepsy	16	13.2	9	56.3	0	0	7	43.7
Personality disorder	51	42.1	6	11.8	16	31.4	29	56.9
Psychoneurosis	28	23.1	5	17.9	4	14.3	19	67.9
Intracranial injuries	10	8.3	2	20.0	2	20.0	6	60.0
Otherwise ¹	16	13.2	3	18.7	5	31.2	8	50.0
Admission diagnosis: Diagnosis un- determined (neurological observa- tion)	9		1	11.1	4	44.4	4	44.4
Discharged as:								
Epilepsy	3	33.3	0	0	3	100.0	0	0
Personality disorder	4	44.4	1	25.0	1	25.0	2	50.0
Psychoneurosis	1	11.1	0	0	0	0	1	100.0
Intracranial injury	1	11.1	0	0	0	0	1	100.0

¹ Hypertension, cerebral arteriosclerosis, neuritides, chorea, multiple sclerosis, etc.

TABLE 4.—*Comparison of admission and discharge diagnoses correlated with EEG findings in 198 cases of psychoneurosis, diagnosis undetermined (psychoneurosis), personality disorder, and combat fatigue*

	Patients		Abnormal		Minimal		Normal	
	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Admission diagnosis: Psychoneuro- sis	81		12	14.8	15	18.5	54	66.7
Discharged as:								
Psychoneurosis	36	44.4	8	22.2	5	13.9	23	63.9
Otherwise	45	55.6	4	8.9	10	22.2	31	68.9
Admission diagnosis: Diagnosis un- determined (psychoneurosis)	26		7	26.9	4	15.4	15	57.7
Discharged as:								
Psychoneurosis	2	7.7	0	0	1	50.0	1	50.0
Personality disorder	20	76.9	5	25.0	3	15.0	12	60.0
Otherwise	4	15.4	2	50.0	0	0	2	50.0
Admission diagnosis: Personality dis- order	60		15	25.0	17	28.3	28	46.7
Discharged as:								
Personality disorder	45	75.0	9	20.0	13	28.9	23	51.1
Otherwise	15	25.0	6	40.0	4	26.7	5	33.3
Admission diagnosis: Fatigue, com- bat	31		6	19.4	6	19.4	19	61.3
Discharged as:								
Psychoneurosis	25	80.6	5	20.0	3	12.0	17	68.0
Personality disorder	4	12.9	0	0	3	75.0	1	25.0
Otherwise	2	6.5	1	50.0	0	0	1	50.0

TABLE 5.—*Comparison of admission and discharge diagnoses correlated with EEG findings in 74 cases of headache, diagnosis undetermined (headache), and intracranial injury*

	Patients		Abnormal		Minimal		Normal	
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent
Admission diagnosis: Headache and diagnosis undetermined (headache).....	58		12	20.7	7	12.1	39	67.2
Discharged as:								
Personality disorder.....	25	43.1	4	16.0	1	4.0	20	80.0
Intracranial injury.....	11	18.0	5	45.5	2	18.2	4	36.4
Psychoneurosis.....	16	27.6	2	12.5	4	25.0	10	62.5
Otherwise.....	6	10.3	1	16.7	0	0	5	83.3
Admission diagnosis: Intracranial injury.....	16		2	12.5	2	12.5	12	75.0
Discharged as:								
Intracranial injury.....	7	43.7	2	28.6	1	15.3	4	57.1
Otherwise.....	9	56.3	0	0	1	11.1	8	88.9

TABLE 6.—*Comparison of percentage of abnormal EEG's in similar age groups of controls, psychopaths (personality disorders), and psychoneurotics (3)*

	Number of patients	Percent
Control group (Greenblatt).....	240	10
Control group (Rossen).....	200	¹ 15.5
Psychopathic personality and behavior disorder (Greenblatt).....	295	31
Personality disorders (Rossen).....	310	² 36.8
Psychoneurosis (Greenblatt).....	218	34
Psychoneurosis (Rossen).....	211	³ 36

¹ Abnormal, 6 percent; minimal, 9.5 percent.² Abnormal, 13.9 percent; minimal, 22.9 percent.³ Abnormal, 21.3 percent; minimal, 14.7 percent.TABLE 7.—*Comparison of distribution of EEG findings in selected groups of young men of military age*

	Percent
Group A-1—200 pharmacist's mates ¹ (purified control group) (Rossen) :	
Greatly abnormal.....	6
Slightly abnormal.....	9.5
Normal.....	84.5
Group A-2—148 candidates for military service ² (Gibbs) :	
Greatly abnormal.....	3
Slightly abnormal.....	11
Normal.....	86
Group B-1—59 pharmacist's mates ¹ (portion of the control group with neuropsychiatric symptoms) (Rossen) :	
Greatly abnormal.....	13.6
Slightly abnormal.....	28.8
Normal.....	57.6
Group B-2—127 candidates for military service ¹ (Gibbs) :	
Greatly abnormal.....	8
Slightly abnormal.....	37
Normal.....	55

NOTE.—Groups A-1 and A-2 had no history of severe head injury or neuropsychiatric disorder; groups B-1 and B-2 showed positive history of severe head injury or neuropsychiatric disorder.

¹ Pharmacist's mates attending school, all of whom had from 18 months to 5 years of service.

² Candidates for military service.

TABLE 8

	Percent
730 adult epileptics (Gibbs):	
Greatly abnormal.....	51.3
Slightly abnormal.....	32.4
Normal.....	16.3
127 patients observed in grand mal seizures (Rossen):	
Abnormal.....	63
Minimal.....	11.8
Normal.....	25.2
234 surveyed with diagnosis of epilepsy (Rossen):	
Abnormal.....	50.4
Minimal.....	19.3
Normal.....	30.3
70 surveyed with diagnosis of epilepsy ¹:	
Abnormal ²	47.1
Minimal ²	15.7
Normal.....	37.1

¹ Observed in an unconscious attack with no other signs of grand mal seizures.

² Corresponds closely to Gibbs' "greatly abnormal."

³ Corresponds closely to Gibbs' "slightly abnormal."

TABLE 9.—Comparison of control group (200) with 95 patients admitted to hospital with diagnosis of fatigue, combat or operational, with 71 of control group who saw combat in 1 or more campaigns

	Number	Percent		Number	Percent
Control group.....	200	100	Portion of control group who saw combat in 1 or more campaigns.....	71	100
Abnormal.....	12	6	Abnormal.....	6	8.5
Minimal.....	19	9.5	Minimal.....	9	12.7
Normal.....	169	84.5	Normal.....	56	78.9
Combat or operational fatigue.....	95	100			
Abnormal.....	15	15.8			
Minimal.....	21	22.1			
Normal.....	59	62.1			

COMMENT

Analysis of the data shows that of 873 cases 226 were discharged with the diagnosis, epilepsy and 647 with various other diagnoses. Of the 226 discharged with diagnoses of epilepsy 50 percent showed abnormal EEG and 19.9 percent showed slightly abnormal EEG. Of the remaining 647 cases with other discharge diagnoses which included various functional neuropsychiatric and organic neurological conditions 18.4 percent had abnormal EEG and 20.7 percent had slightly abnormal EEG.

The data presented shows that the EEG findings in naval and marine personnel with various neuropsychiatric conditions closely approximates those found in civilian series and reported by other workers (3) (6) (8) (see tables 6, 7, and 8). Comparison with a control series (1) of naval personnel in a like age group without neuropsychiatric symptoms reveals a higher incidence of EEG abnormalities in patients discharged from the service with various functional

neuropsychiatric disorders. However in comparison with a small series (1) of the "control reject group" (59 of 259 men in the control series who showed neuropsychiatric symptoms) there is no significant difference in EEG findings as compared with the group discharged with the diagnosis of psychoneurosis and personality disorder. There is a complex factor which can be referred to as good motivation which is apparently very important in determining which men continued with military service regardless of neuropsychiatric symptomatology or EEG findings. This is exemplified in the "reject" control group which showed as high EEG abnormalities and essentially the same symptoms as those discharged from the service with functional neuropsychiatric diagnoses. All of these men ("reject" control group) had from 18 months to 5 years of service and half of them had had foreign or combat duty. It would therefore appear that clinical neuropsychiatric evaluation is at present a superior tool to EEG examination alone in determining qualification for military service except in convulsive disorders.

This is in agreement with other investigators (6) who thought that the use of the EEG in screening Army entrants or soldiers who have suffered neurotic breakdown should be engaged in with the utmost caution. Table 9 shows a comparison of a control series, a group of 95 patients who were admitted to the sick list with diagnoses of combat or operational fatigue, and a group of 71 "controls" who had experienced combat but who were not on the sick list and who did not voice any neuropsychiatric complaints. The EEG examination is a valuable diagnostic adjunct, particularly regarding the convulsive disorders and organic neurological diseases. In the functional neuropsychiatric disorders it is of minor value but should not be totally disregarded. It will suffice here to state that the EEG abnormality is, as might be expected, significantly higher in patients who were discharged with a diagnosis of epilepsy. A comparison of the EEG findings in headache with other workers (2) discloses a marked similarity especially in cases of headache on a nontraumatic basis. It should be emphasized that headache of an apparently nonorganic type was a very common symptom in cases discharged with diagnosis of psychoneurosis and personality disorder. Questionable motivation, life-long inadequacies, and emotional instability were found to be underlying factors in a large number of patients who voiced various somatic complaints especially the symptoms of "fainting," "dizzy spells," and headaches.

CONCLUSIONS

1. Statistical evidence is presented on the results of 873 EEG examinations as correlated with the admission and discharge of diagnoses (table 1).

2. In 873 cases analyzed the highest correlation of admission and discharge diagnoses lies in the epilepsy and personality disorder groups. (See tables 2, 3, 4, and 5.)

3. The highest percent of EEG abnormalities was noted in the groups admitted and discharged with the diagnosis of epilepsy but of 469 cases admitted with a possible convulsive disorder only 206 cases were discharged with the diagnosis of epilepsy. Of this group 469 cases the average abnormal and slightly normal EEG's were 50 percent as compared with the abnormal and slightly abnormal EEG's which were 70 percent in the 206 who were discharged with the diagnosis of epilepsy. However, the slightly abnormal EEG's were about 20 percent for both the total admission group of 469 and the 206 cases discharged as epilepsy.

4. The EEG findings in the groups discharged with diagnoses of psychoneurosis and personality disorder tend to agree with the EEG findings in a similar group of civilians reported by other workers (2) (3) and by investigators working with military personnel (6). The same is true in regard to headache of a nontraumatic nature (2).

5. The EEG findings in a series admitted with the diagnosis of fatigue state (combat or operational) tended to approximate those of the psychoneurosis and appeared to be significantly higher as compared with a group of "controls" who had been in combat and who had had over 18 months and up to 5 years of service but who were not on the sick list and who did not present any neuropsychiatric symptoms.

6. Forty-four percent of the 469 patients who were admitted with the diagnosis of a possible convulsive disorder was discharged with the diagnosis of psychoneurosis or personality disorder.

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THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



FUNDAMENTAL DIFFERENCES IN THE FIELD OF MEDICINE IN WORLD WAR II AND PREVIOUS WARS

1. There are some significant differences in the employment of the medical profession in World War II and in previous wars. The most notable is that in World War II the humanitarian aspects of medicine were subordinated in a great measure to military uses, and new medical discoveries and advances kept secret so as to deny them to nations at war with us or considered unfriendly to us. New therapeutic agents and new methods of disease prevention were alike withheld. This is a complete reversal of the ethical current which from the time of Hippocrates has continued in one direction only, namely toward the relief of human suffering without reference to national, racial, or social differences. It is remarkable that there is nowhere to be found any opposition to this use of the medical profession though it constitutes an employment counter to the age-old ethical concepts of medicine and at variance with its long-expressed ideals.

2. The second most important change was the introduction of an entirely new weapon with entirely new medical and surgical effects, namely, the atomic bomb. Just as in World War I, gas warfare was the most remarkable new weapon, inflicting unusual wounds, so in this war the atomic bomb produced a new type of casualty. In nearly all previous wars some new weapon has been developed, but not since the use of gunpowder has there been so revolutionary a weapon introduced into warfare, producing unusual wounds and medical problems.

3. The third feature of this war in which it differed from previous wars was the greater employment of complex mechanical weapons of all sorts, as a consequence of which there was a very high proportion of casualties among our own forces due to the operation of these weapons in training and in the movement of military forces by high speed transportation methods.



SMALLPOX AND BLINDNESS

A medical officer of the British colonial medical service in Nigeria, Africa, recently made a study of blindness in a community of almost 35,000 persons there. The total of blind was nearly 500. This gives an incidence of 1.4 percent. The incidence of blindness was considered to be, however, about 2 to 2.5 percent of the population as there was much concealment in making the census. Another observer in South Africa reported an incidence for South African natives as high as 5 percent. Nearly one-half the cases occurring in infancy were due to smallpox. Ophthalmia neonatorum and cataract made up most of the remainder. The author of the study, Dr. Francis E. Stork, believes that compulsory smallpox vaccination, prevention of ophthalmia from venereal disease and a diet containing adequate amounts of vitamin A would eliminate 80 percent of the blindness there.

The most interesting feature is possibly the fact that nearly half of all cases are due to smallpox. We have forgotten in civilized communities where vaccination has now been practiced, to some degrees at least, since the announcement of Jenner's discovery 149 years ago, what a terrible disease smallpox was in prevaccination days. It killed, disfigured, and blinded more than all the other infections and contagious diseases of the temperate zone. Particularly its production of blindness has been forgotten.

Placing the rate for blindness from smallpox at the conservative rate of 2 percent a graphic picture of the results can be appreciated quickly if applied to our population of about 140,000,000 people. It would mean 2,800,000 blind persons in the United States from smallpox alone. The number blinded by smallpox in this country even with imperfect smallpox vaccination is only a few hundreds. In this one particular alone we see our debt to Jenner and his great discovery—one of the greatest in the history of medicine.



TETANUS AND MILITARY MEDICINE

Tetanus is one of the master killers among diseases. There is no way to number its victims, for vast numbers of them are among the infants of tropical areas of Africa and Asia where infection of the umbilical cord of the newborn is common and with almost a 100 percent mortality. In countries where statistical information is available,

the number of lives lost from tetanus before preventive measures were taken was very great. In World War I the average rate for the German Army was 380 per 100,000 wounded with about 300 deaths per 100,000. On a basis of about 4,000,000 wounded this meant 12,000 deaths from tetanus alone.

The first move toward the conquest of tetanus was tetanus antitoxin. The second was the development of tetanus toxoid and its use as an immunizing agent by armies and navies and by industrial plants. As a result of this use in the Navy and Marine Corps there was only 1 death from tetanus among approximately 3,500,000 officers and men in World War II. There were 2 deaths in World War I among about 500,000. The deaths from tetanus in World War II were therefore about one-fourteenth of World War I.

In the attack on Saipan an opportunity was afforded of seeing the contrast between Japanese wounded of the Imperial Army who had received tetanus toxoid and members of labor groups largely unvaccinated. Among the latter there were nearly 15 percent of deaths from tetanus and not one from the former. Apply such a death rate to hundreds of thousands of wounded and one gets a graphic picture of the lives saved by the use of tetanus toxoid as an immunizing agent.

What is not generally known is the part played by the Medical Department of the Navy in the development of tetanus toxoid or that the United States Navy was a pioneer in its use and in the determination of its value. This development was largely the work of W. W. Hall, a medical officer of the Navy. A group of hospital corpsmen were associated as volunteers on the hospital ship *Relief*. Later the toxoid was used at the Naval Academy at Annapolis to immunize midshipmen, the work being under Capt. R. Hayden and Capt. (then Lt. Comdr.) W. W. Hall. Problems with reactions from the toxoid were solved and here the development of a special test by Chief Pharmacist P. S. Gault was an important factor. The part played by the workers of the Medical Department and by the Navy should be better known, for it was this important work that has provided the tools for the virtual conquest of tetanus, one of the greatest killers of either war or peace.



GENETICS AND INTELLIGENCE

Intelligence is a hereditary quality just as is eye color or other physical characteristics, and late marriages and the lowered fertility of the highly educated group tend to lead to their extinction. This

is the thesis of the 1946 Galton lecturer, Professor Godfrey Thomson, who says, "The educational system of the country acts as a sieve to sift out the more intelligent and destroy their posterity," and he produced strong evidence to prove his contention.

This criticism of the effect on health and mental powers of modern educational programs is beginning to come strongly to the notice of the medical profession that modern educational standards, by increasing the length and severity of high school and college courses, are having an unfavorable eugenic effect.

Criticism of our educational system has been considerable, but in general it has been directed at the subjects taught and the methods of teaching. Criticism of effects on health has usually been limited to the question of the ventilation, heating, or other sanitary features of school buildings, or to the conduct of school cafeterias. In recent years only have the broader aspects been the subject of comment from members of the medical profession.



A PLEA FOR PATHOLOGISTS

The operation of the postgraduate training program in the Navy Medical Corps constantly reveals new problems. The paucity of requests for training in pathology has been singularly outstanding. The excessive number of requests for training in obstetrics and surgery has made it impossible to provide training for all those desiring it in these specialties.

The scarcity of requests for training in pathology is not confined solely to the Navy as the majority of civilian institutions are noting the same trend. The physical equipment of the laboratory and the qualification of the pathologist is the cornerstone of recognition of all hospitals, residencies, and training programs be they Navy or civilian. The Navy has the necessary equipment and qualified pathologists but it needs younger officers expressing a desire to enter the field. The Council on Medical Education and Hospitals of the A. M. A. pays particular attention and stresses the pathology department and holds it to be a mark of professional distinction to have a qualified full time pathologist in charge of the department.

Pathology as a specialty has several advantages. It is the basis for all other types of specialization. A thorough background of pathology is of inestimable value in fundamental medical education. Medical officers entering the field are practically assured of remaining in their specialty and as a result will usually be in a clinical assignment.



CLINICAL NOTES



IDIOPATHIC THROMBOSIS OF THE AXILLARY VEIN

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Idiopathic or so-called "strain" thrombosis of the axillary vein is a relatively rare affliction. Von Schrotter is credited with having reported the first case in 1884. Since then reports of small groups of cases have appeared in the German, English, American, and French literature. The title of "thrombite par effort" used by some French writers has given rise to American writers referring to it as a "strain" thrombosis.

The picture is apt to be misleading when seen for the first time owing to the usual conception of thrombosis as a rather sudden painful occlusion of the veins of one of the lower extremities.

Recently two such cases presented to the writers the following stories:

CASE REPORTS

Case 1.—C. G. F., WT1c., age 24 years, 3 days previously had noted mild aching and unusual fatigue of the right arm at the end of his day's work. Only then did he note that the arm from shoulder to fingers appeared slightly but definitely larger and the veins were unusually distended.

Careful questioning elicited no history of recent injury or unusually strenuous use of the arm.

Physical examination revealed a normal appearing 24-year-old, right-handed American sailor with an enlarged right arm which aside from feeling somewhat "tight" and swollen was not painful or tender. The skin from shoulder to finger tips was dusky red in color and both the cephalic and basilic veins and their tributaries were markedly distended as were the superficial veins over the right pectoral region which flow laterally into the basilic.

The pulse in the two wrists and the arterial pressure in both arms were equal. No palpable abnormalities were felt in the axilla or in the infra or supraclavicular regions. Noteworthy was the absence of distention of the right external jugular vein. Elevation of the extremity for a few minutes improved its color and decreased the venous distention moderately but not entirely. Measurements of the bicipital and forearm circumferences indicated the right to be approxi-

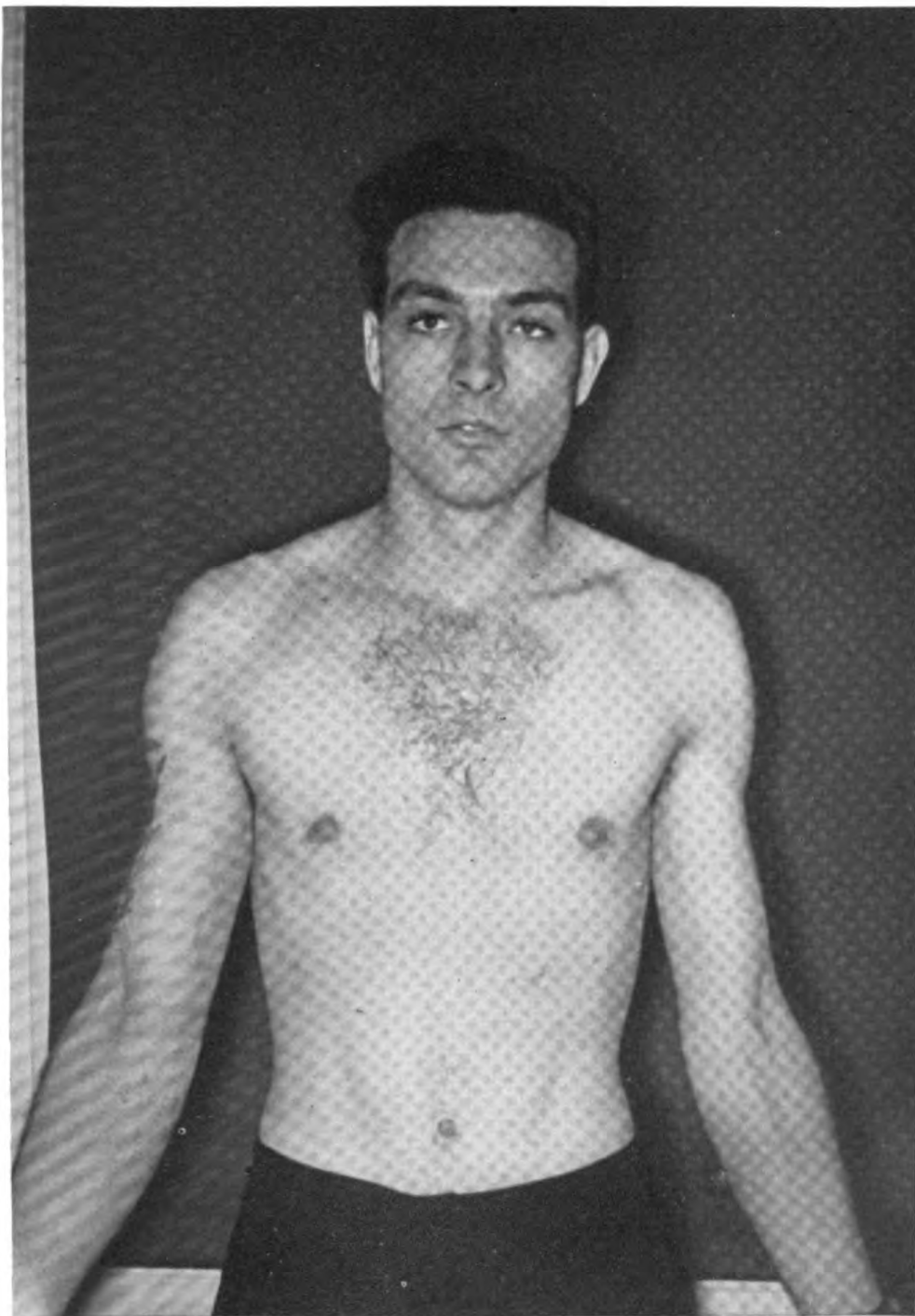


FIGURE 1.—Case 1. Natural photograph reveals tortuous, dilated superficial veins and enlargement of right arm.

mately three-fourths inch greater than the left. Careful test of cutaneous sensation to pin prick revealed no consistent variation from the normal. Muscle power seemed in no way decreased.

Temperature, 97° F.; pulse, 84; respiration, 18; laboratory examination including Kahn, complete blood count, urinalysis, etc., normal.

Anterior-posterior and lateral x-ray pictures of the chest and upper arms revealed no evidence of masses or bony abnormalities. Venous pressure recorded simultaneously in the two basilic veins was: right, 230 mm.; left, 120 mm.

Treatment consisted of elevation of the entire arm and hand on an airplane splint with daily physiotherapy consisting of mild heat and gentle massage. Venography (fig. 2) using 10 cc. of 35 percent diodrast revealed complete obstruction to centripetal venous flow at the confluence of the basilic, cephalic, and pectoral veins.

Case 2.—D. D. M., S1c., a 19-year-old white male, was admitted with the complaint of swelling and tightness in the right arm and shoulder. He had first noticed this on awakening on the morning of admittance. Later on in the day he noticed that the superficial veins over the right shoulder and arm had become

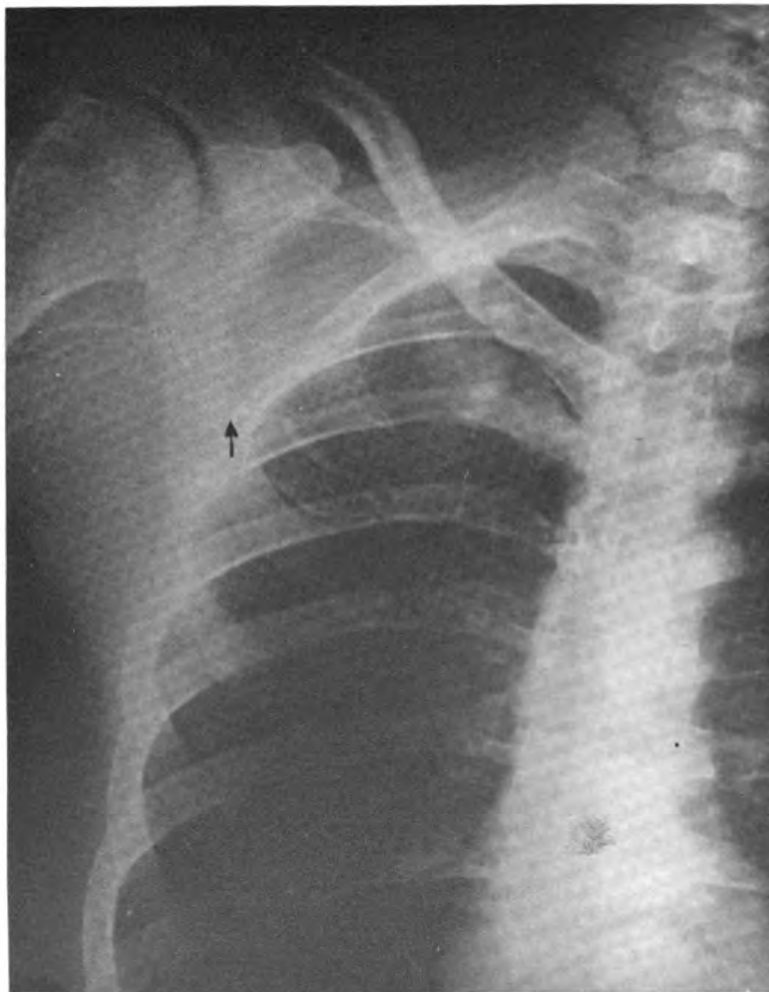


FIGURE 2.—Case 1. Venogram with diodrast reveals absence of the radiopaque substance in the axillary vein and its presence in the superficial vessels distally.

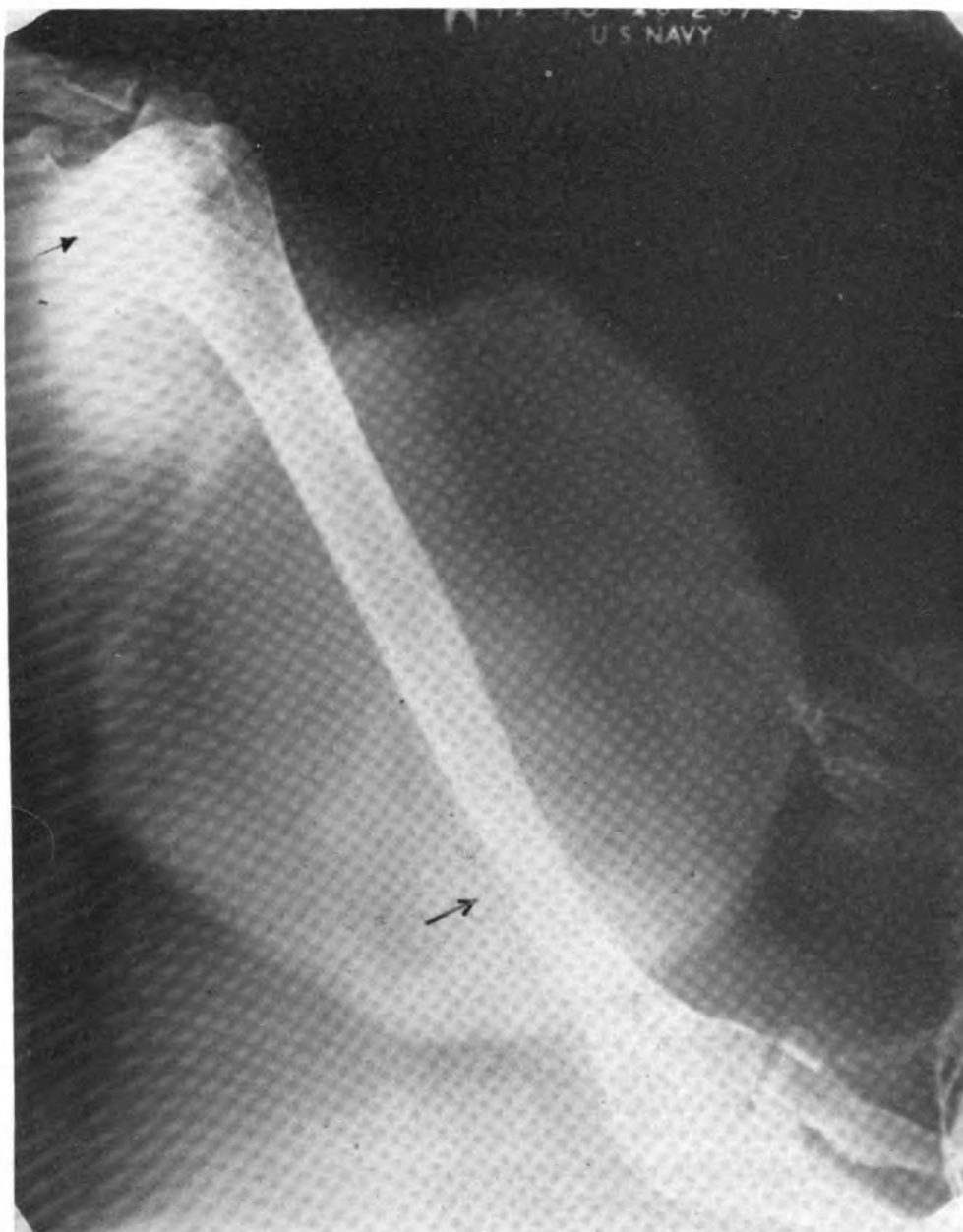


FIGURE 3.—Case 2. Venogram reveals the obstruction to the free flow of the diodrast solution in the brachial vein above the elbow and along course of axillary vein.

more prominent than on the left. There was no history of recent trauma or pain, although in the past the right shoulder had been dislocated several times, the most recent dislocation having occurred 6 weeks previously with the resultant swelling and soreness disappearing in a week.

Physical examination revealed a well-developed, 19-year-old, right-handed white youth with no outstanding clinical findings except an enlarged right arm. There was a definite cyanotic discoloration of the skin of the entire arm, more

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prominent over the distal surface. The superficial veins of the arm and right pectoral area were greatly distended.

No differences in the pulse could be detected but the pulse pressure was found to be greater on the right after determination by brachial readings with right 114/56, left 106/62. There was a tender, ropelike mass palpable in the right axilla, extending down the medial surface of the arm to the level of deltoid insertion.

The right arm and forearm were approximately 1 inch greater in circumference than the left. No sensory changes were noted but some weakness in the muscles was demonstrable. The venous pressure recorded simultaneously in the

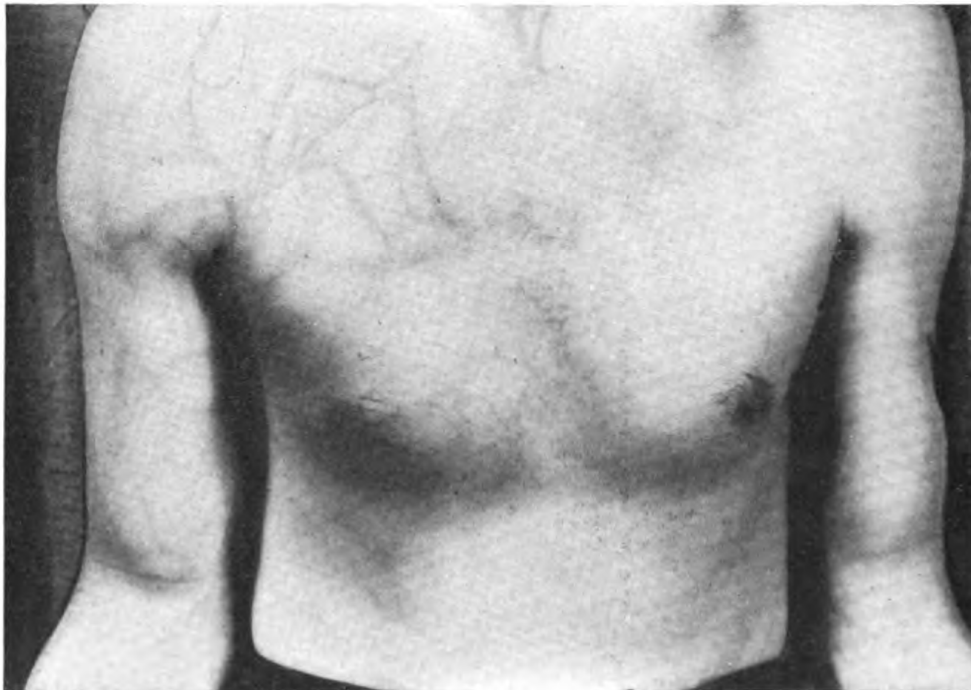


FIGURE 4.—Case 2. Infra-red photograph.

two basilic veins, which were level with the right atrium, was left 90 mm., right 425 mm.

Temperature 99.2° F., pulse 92, respiration 18. Laboratory examinations, including blood Kahn, urinalysis, complete blood count, and erythrocyte sedimentation rate were negative.

X-ray (anterior-posterior and lateral) of the upper arm and chest revealed no evidence of abnormal masses or bone pathology. Venography (fig. 3) using 15 cc. of 35 percent diodrast, revealed complete obstruction in the basilic vein approximately 13 cm. above the elbow joint, with the superficial veins of the arm and shoulder dilated and filled with the diodrast solution. Infra-red photography (fig. 4) brought out the marked dilatation and tortuosity of the superficial veins of the affected right side as compared with the normal left.

Treatment in this case consisted of elevation of the arm in an airplane splint, heat, and 30,000 units of penicillin every 3 hours until the slight temperature elevation had returned to normal in 2 days.

These cases follow closely the usual pattern of published cases except that in at least two-thirds of those reviewed there was some closely allied preceding injury or unusual activity of the involved arm.

The typical case is that of a young male between 20 and 30 years old, usually with involvement of the right arm except where he is left-handed or involved in some special maneuver requiring unusual activity of the left arm. More often than not the onset of signs and symptoms is 2 to 4 weeks prior to consulting the physician, indicating absence of severe symptoms and anxiety over the condition. The arm is swollen, somewhat cyanosed, and often slightly warmer. Elevation with heat for 2 to 4 weeks usually results in subsidence of symptoms of "tightness" and aching whereas the venous engorgement and dusky cutaneous color almost always persist for a matter of months. Only 2 deaths appear to be reported in the literature as connected with the condition out of a total of approximately 50 cases. Resection of the vein with removal of the clot has been reported by several enthusiasts but the concensus is toward conservative treatment.

Several theories exist concerning the etiology among which are:

(a) Distention of the veins, due to back pressure from increased intrathoracic pressure, resulting from the expiratory effort associated with unusual exertion of the arms.

(b) Pressure exerted by the costocoracoid ligament during abduction of the arm causing damage to the axillary vein as revealed by anatomical dissections of Lowenstein.

(c) Damage to the subclavio-axillary venous valve by stretching of the large vein by pressure from the adjacent subclavius muscle when the arm is abducted said to have been demonstrated by plaster-of-paris injections of the axillary veins of cadavers by Gould and Patey.

SUMMARY

1. Two cases of thrombosis of the axillary vein are presented.
2. The cases follow the usual pattern except for absence of any known causative trauma.
3. Corroborating venography and venous pressure readings are presented.
4. Improvement of mild symptoms and some decrease in venous engorgement have resulted from heat and elevation.

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TUBERCULOSIS PERICARDITIS IN A CASE OF ACUTE HEMATOGENOUS TUBERCULOSIS

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Tuberculosis pericarditis is a relatively rare and usually an insidious complication of a hematogenous or mediastinal tuberculous infection. The following case clinically was manifested by its pericardial involvement, sudden onset, stormy course, and rapid termination. Death was attributed to general toxemia and secondary cardiac failure. Tuberculosis etiology was strongly suggested by the history of repeated large pericardial aspirations and changing character of the fluid from a serofibrinous nature initially to subsequent sanguino-fibrinous.

CASE REPORT

This Italian male was admitted to this hospital in a semimoribund condition. Three or four weeks previously, he had a mild pharyngitis which was treated symptomatically with gargles and sulfa therapy. A few days later he developed a cardiac arrhythmia which was interpreted as resulting from a complicating pneumonitis. During the period of transportation here, 2 weeks after onset of his illness, the diagnosis of pericardial effusion was established for which he was treated with an indefinite amount of penicillin. Three pericardial aspirations were performed with the removal of 300 to 500 cc. of fluid each time. The initial fluid was reported as fibrino-serous while subsequent aspirations were reported as sanguino-fibrinous.

On admission to this hospital his temperature was 105.8° F., pulse 150, respiration 36, and his blood pressure was 125 systolic over 70 diastolic. He was obviously in a critical condition, being orthopneic, dyspneic, and responding only to painful stimuli. His skin and sclera revealed a mild icterus. Physical examination of chest revealed coarse breath sounds over the entire left lung with a small area at the base close to the vertebral column over which there was increased vocal fremitus. The left border of the heart was percussed well

beyond the midclavicular line. The heart tones were of poor quality and distant in sound. He had a tachycardia with occasional ventricular extrasystole. There were no audible murmurs. The abdomen was soft and the liver was easily palpable two finger breadths below the right costal margin. There was questionable ascites. The lower extremities revealed a 2 plus pitting edema. The remainder of the physical examination was negative.

Immediately upon admission, he was given oxygen by mask. The first x-ray picture of the chest taken in a semirecumbent position was reported as follows:

"A large bottle-shaped heart is seen with the left cardiac border extending almost to the edge of the thoracic cage. There is a diffuse fan-shaped increase in lung markings conforming to the bronchio-vascular tree on the right side. That portion of the left upper lobe not obscured by the large cardiac shadow is slightly hazy. No definite fluid can be determined. No paratracheal adenopathy is seen. Impression: Pericardial effusion with pulmonary congestion."

Using the anterior approach a pericardial aspiration was performed with the removal of 480 cc. of fibrinous bloody fluid. Pending the laboratory reports on the smear and culture of the aspirated fluid, 60,000 units of penicillin was administered into the pericardial sac. He was also started on intravenous sulfadiazine therapy.

For a temporary period of time, the patient appeared less dyspneic and more alert, but this was soon followed by progressive rise of temperature and coma. He expired 6 hours after admission.

The essential laboratory data are as follows:

White blood cells 15,200 (polymorphonuclears 90 percent, lymphocytes 20 percent).

Hemoglobin 12.5 grams.

Urine: 2 plus albumin, and 20 red blood cells per high power field.

Nonprotein nitrogen was 100 milligram percent.

Icteric index was recorded as 20.

Examination of the pericardial fluid revealed 125,000 red blood cells per cu. mm.; 1,500 white blood cells per cu. mm. (95 percent polymorphonuclears), and "acid-fast tubercle bacilli too numerous to count."

Spinal fluid examination revealed no increase in cells, normal protein content (Heller's method), and negative Kahn.

Summary of post-mortem examination is as follows:

(1) Pulmonary tuberculosis, minimal right.

There was approximately 500 cc. of clear dark fluid in each pleural cavity. Surfaces are glistening. Section shows red, crepitant, edematous parenchyma throughout which frothy fluid is easily expressed. In the middle of the right upper lobe is a 1-centimeter, round, granular, yellowish-white, firm, well defined lesion, somewhat caseous in the center.

(2) Tuberculosis of the mediastinal lymph nodes with caseation and extensive abscess formation of the posterior mediastinal nodes.

(3) Tuberculosis of the pericardium, advanced.

The pericardial cavity was greatly enlarged, the wall was 2 to 5 mm. in thickness and firmly adherent to the mediastinal lung surface. The cavity contained 100 cc. of dirty bloody fluid. The lining surfaces were a dirty yellowish gray with a "bread and butter appearance." The heart was estimated to weigh 350 grams. The ventricular surface was covered with 1 mm. layer of friable, fibrinous material. The myocardium was pale. The valves were not remarkable. The coronary arteries appeared normal.

- (4) Pleural effusion of 500 cc. of dark yellow fluid, bilaterally.
- (5) Ascites, of approximately 1,000 cc. of clear dark yellow fluid.
- (6) Tuberculous ulceration of the ileocecal junction, with abscess formation and caseation of the regional lymph nodes.
- (7) Miliary tubercles of the spleen, liver, and kidneys.

MICROSCOPIC PATHOLOGY

Heart.—The section of the left ventricle shows the myocardium to be continuous with a greatly thickened epicardial layer composed of a dense meshwork of pink and purple staining material, throughout which there are numerous polymorphonuclear leukocytes and remnants of cell nuclei. The outer portion of this exudative layer shows fewer cells, while the inner layer which involves about 2 mm. of the heart muscle shows not only numerous polymorphonuclear cells but a few lymphoid and large mononuclear cells. Organization is evident here by presence of numerous capillaries and fibroblasts. Strands of heart muscle are still seen in this part. The remaining heart muscle and endocardium are not remarkable.

Lung.—A section through the single tuberculous lesion, previously described in gross, shows a minimal cellular response and thrombi are present in the venules. Tubercle bacilli are so abundant on acid-fast stain as to appear as large red masses filling the alveoli. Hemorrhagic infarction is prominent. Giant and epithelioid cell response is practically absent. Some older foci of necrosis show hyalin fibrosis peripherally.

Lymph node from the hilum of the lung.—The entire nodal architecture is replaced by fibrinocaseous necrotic exudate. The veins are thrombosed and the adjacent areas are infarcted. The capsule is intact and shows a few remaining lymphocytes. Giant cell and epithelioid cell response is practically absent.

Spleen.—The capsule is negative. The general architecture is still recognizable. The red pulp and malpighian bodies are studded with areas of necrosis in which polymorphonuclear and mononuclear cells are recognizable. Acid-fast stain shows masses of acid-fast bacilli in the center of these areas.

Liver.—The capsule is normal. Architecture is generally recognizable, but approximately half of the liver cells are destroyed. Focal tubercles of fibrinocaseous exudate without cellular response are numerous. Passive congestion has resulted in marked atrophic necrosis of the central liver cords. Moderate monocytic infiltration is present in the portal areas. Giant cell and epithelioid response is minimal.

We have just reviewed a case of generalized tuberculosis in which the general toxemia and pericardial involvement were the outstanding clinical characteristics. The extensive involvement of the liver and serous membranes was manifested by jaundice, and fluid in the pleurae, peritoneum, and pericardium. It is our opinion this clinical picture resulted from the rupture of a mediastinal abscess into the blood stream and hematogenous spread to many organs.



ACCIDENTS RESULTING FROM LOOSE DENTAL OBJECTS
IN THE MOUTH

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Several cases have recently come to the attention of the author of accidents resulting from the displacement of loose dental objects. Although fully aware of the low statistical significance of three case reports of similar circumstances, it is the opinion of the author that the incidence, regardless of their low incidence, and the serious prognosis of cases of this type make this report justifiable.

CASE REPORTS

Case 1.—A 50-year-old male was admitted to the hospital at 3:30 p. m. complaining of dyspnea, severe constricting pain in the throat and neck, spitting blood, tremors, chills, and dysphagia.

A brief history of his present illness revealed that as the patient was boarding a bus at about 1 p. m. on the day of admission, he was seized with severe tremors and fell to the street striking the front of his head against the pavement. The patient immediately became dyspneic, very cyanotic, made loud crying noises, and spit up a moderate amount of frothy fluid. Since that time the patient had had severe pain in the back of his neck and in his throat which radiated intermittently down under the sternum. The patient continued to spit up frothy fluid with a moderate amount of bright red blood.

The past history of the patient brought out only one relevant point, that 3 years previously he had been shot through the neck with a bullet. This bullet was removed surgically, with no subsequent complications.

The physical findings revealed a hard palpable mass about a half inch in diameter in the soft tissues of the left side of the neck in the supraclavicular region. There was also evidence of a spontaneous pneumothorax on the left side. There was marked subcutaneous emphysema of the lower neck and about the manubrium sterni. X-ray examination showed the presence of air alongside the trachea and in the pericardium. Fluoroscopic examination indicated the presence of a partial denture at about the level of the larynx.

The following procedure was initiated immediately after the above findings were made.

Under 2 percent pontocaine topical anesthesia, a laryngoscope was inserted and a partial denture consisting of four anterior teeth and a full vulcanite palatal base was removed. No perforation of the soft structures of the throat was visible. There was a profuse hemoptysis which subsided spontaneously. Subsequently the respirations and subcutaneous emphysema improved. It was decided at this time that there was no pneumothorax present. The patient remained slightly cyanotic.

On the following day the patient was given 10 cc. of a radiopaque substance (Iliodal) orally. Roentgenographic examination showed most of the Iliodal to be in the posterior mediastinum indicating a perforation of the posterior wall of the esophagus.

A posterior mediastinotomy was performed and a catheter placed in the open-

ing. One million units of penicillin were introduced into the posterior mediastinum per catheter and the patient returned to bed. All other recommended postoperative treatment was administered, including massive doses of penicillin. The patient died on the second postoperative day.

The final diagnosis after autopsy was suppurative mediastinitis, secondary to perforation of the esophagus by a partial denture.

Case 2.—A 16-year-old, well-developed white male was admitted to the hospital at 7:40 p. m. having severe respiratory distress. He was unconscious, cyanotic, and using all accessory muscles of respiration. It was noticed that the lower right second molar tooth had been removed recently. There was clotted blood in the mouth, throat, and pharynx. Respirations were accomplished by a short inspiration and a prolonged, high-pitched, wheezing expiration.

No history of the patient was obtainable except that it was thought he had an epileptic seizure.

Oxygen was given immediately by nasal catheter. Aminophyllin, coramine, and epinephrine were administered. The patient regained consciousness and was able to nod his head in answer to questions. By this means a history was obtained which revealed that the patient had aspirated a gauze sponge which had been placed over the tooth following its extraction.

Further investigation at a later date disclosed that the patient had been permitted to leave the dentist's office with the sponge in his mouth in order to control hemorrhage from the socket, and that he had an epileptic seizure about 1 hour following the extraction.

The patient was immediately prepared for bronchoscopy, but suffered complete respiratory arrest before this was completed. A bronchoscope was introduced and the gauze sponge located at the bifurcation of the trachea and removed.

Artificial respiration was begun immediately. Intracardial adrenalin and heparin and intravenous ephedrine and alpha-lobeline were given. All efforts to revive the patient were in vain.

Case 3.—A 52-year-old, well-developed white male was admitted to the hospital following an automobile accident. The patient had apparently struck the center post of the steering wheel with his body in the right supraclavicular region, and the upper rim with his anterior maxilla.

The patient was apparently unconscious and experiencing extreme respiratory difficulty. There was profuse hemorrhage from the mouth. The tongue was badly lacerated, slightly swollen, and protruding from the mouth. There was a large area of swelling in the cervical region and crossed the midline anteriorly. This was apparently an hematoma. Intra-oral and laryngoscopic examination revealed that the upper six anterior teeth were loose and the roots fractured. Numerous fragments of a shattered acrylic upper partial denture were also found in the mouth and some in the pharynx and larynx. All visible fragments were retrieved but reconstruction of the denture was impossible because of missing pieces, leaving question as to other fragments remaining in the patient. Endotracheal intubation was attempted in order to give the patient some respiratory relief. This was unsuccessful due to the extensive edema of the larynx. Following this a bronchoscope was successfully introduced and an immediate tracheotomy was performed.

The patient regained consciousness on the third day following the accident and made an uneventful recovery henceforth.

The chief factor which warrants emphasis in this instance is that it could not be positively determined at an extremely critical time

whether or not a fragment of the acrylic denture was lodged in the esophagus, trachea, or bronchi due to the radiolucency of acrylic denture material.

The three case reports presented here suggest the possibility of considerable hazard involved in a number of common procedures. In recapitulation these are as follows:

1. The inadvisability of allowing a patient to leave the office following removal of a tooth until hemorrhage from the socket is sufficiently controlled to eliminate the use of hemostatic measures.

2. The advantage of the earliest possible determination of the cause of an obstructive type of respiration.

3. The manner in which acrylic denture material shatters, producing fragments like those of shattered glass.

4. The hazard produced by the fact that acrylic is used for denture construction is not opaque to x-rays. Due to the ever-increasing use of acrylic material for crowns, inlays, bridges, facings, and orthodontic appliances as well as for full and partial denture construction, it seems evident that greater emphasis should be placed on the fact that acrylic as used for dental purposes presents a definite hazard due to its radiolucency.

From the above reports it appears to behoove the dental practitioner to use careful judgment in application of the techniques and methods which are employed as common practice today.



SALIVARY CALCULUS IN THE SUBMAXILLARY DUCT AND ITS REMOVAL

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The formation of salivary calculus is not necessarily confined to the oral cavity; occasionally it may occur within one of the salivary ducts or even within a salivary gland itself. It has been estimated that 80 percent of such calculi occur in the submaxillary gland or duct, 15 percent in the sublingual gland or duct, and 5 percent in the parotid gland or duct. A review of the literature from 1825 to 1926 revealed only 375 reported cases of the formation of salivary calculi within ducts or glands.

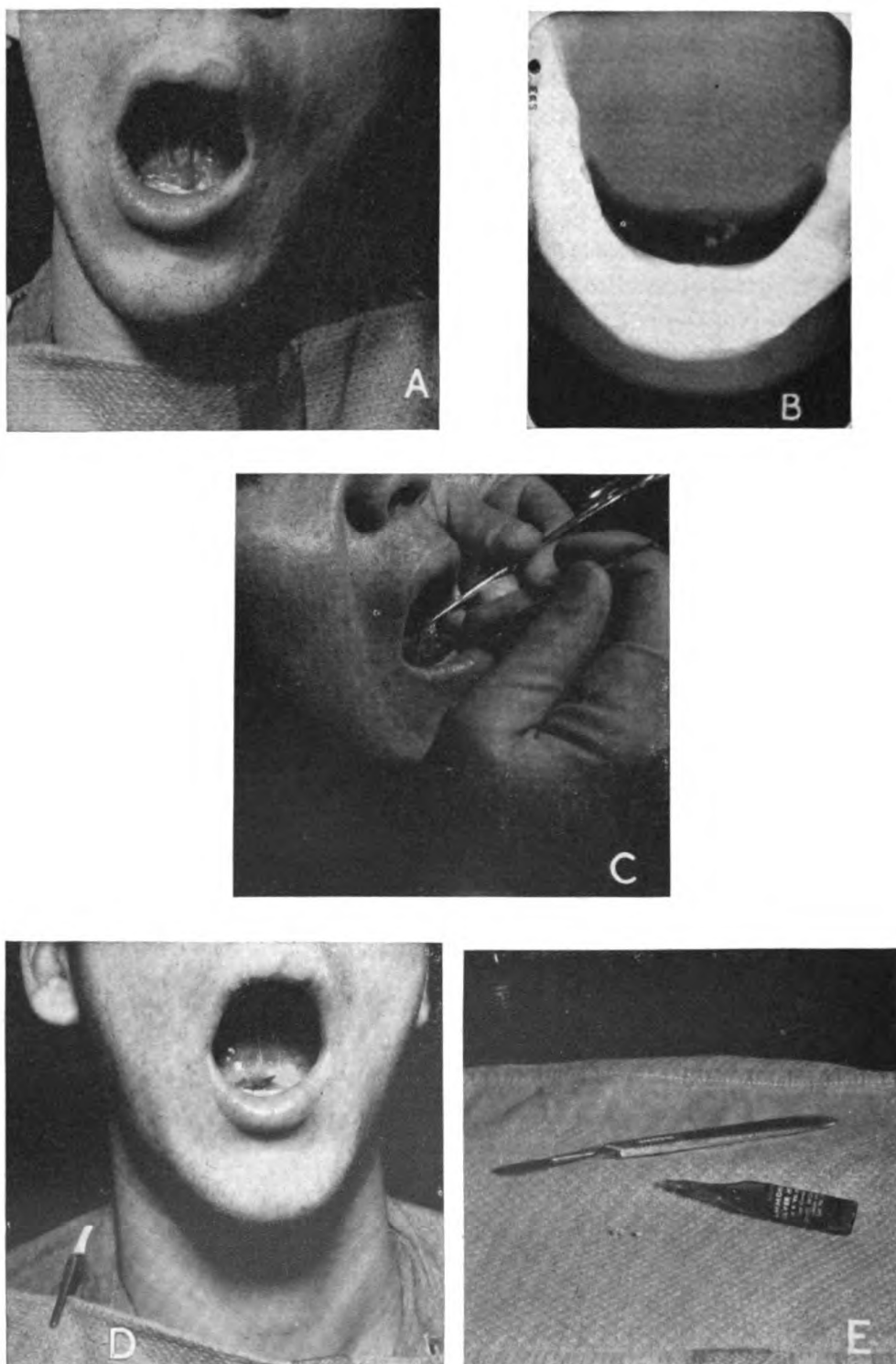


FIGURE 1.—(A) Swelling along Wharton's duct; (B) x-ray revealing position of stones; (C) Wharton's duct and enclosed stones; (D) rubber dam sutured into duct; (E) comparison of removed stones.

CASE REPORT

The patient, a 19-year-old seaman, complained of slight swelling and dryness, particularly upon awaking, in the region of the duct of the right submaxillary gland. This condition had existed for a period of 6 months (fig. 1A).

It is interesting to note that neither pain nor swelling occurred in the submaxillary gland previous to mealtime as is usually the case. This may have been due to the fact that the lumen of Wharton's duct was enlarged in the area of the stones permitting saliva to escape around the stones. This was concluded when the two hard nodules were palpated and found to be movable for a short distance within the duct in its anterior third. Roentgenographs further revealed the presence and position of the stones (fig. 1B).

Under local anesthesia an incision was made in the direction of the duct which revealed the duct and the enclosed nodules of calculi (fig. 1C). These were removed after further incision. A thin strip of rubber dam was then inserted and the duct sutured (fig. 1D). These were removed 4 days later. Healing was rapid.

A complaint of pain later in the day was alleviated by $\frac{1}{4}$ grain of codeine sulfate.

The calculi were respectively about 1 and 2 mm. in length (fig. 1E).

A CASE OF GAS GANGRENE OF NECK FOLLOWING
EXTRACTIONS

CYRUS E. WARDEN

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The case herein described is presented because of its uniqueness and because it calls attention to a potential danger inherent in the suture of an infected wound.

CASE REPORT

The patient was a 32-year-old fireman, first class, whose previous history is irrelevant.

At 0730 on 23 July 1945 the dental officer extracted four teeth (17, 18, 20, and 21) from the patient's lower right jaw because of severe pyorrhea. Mandibular block with procaine hydrochloride was used. Following extraction five sutures were loosely placed through gum margins over iodoform gauze drains. At 0930 the patient returned to the dentist complaining of swelling of the jaw. An ice pack was prescribed. At 1030 swelling had increased and the dentist ordered a white blood count with the intention of seeing whether the use of sulfadiazine would be contraindicated.

The patient apparently made no further complaint until 1545 at which time he complained to a corpsman that he was beginning to feel as though he would choke to death.

The patient was seen then for the first time and the following note was made: Right side face over mandible is swollen and crepitation is felt in tissues as

high as zygoma. Right side of neck is swollen and crepitation is felt throughout right anterior and posterior triangles and in suprasternal notch. Interior of mouth shows no marked pathology. Gums not noticeably swollen. No swelling of palatine tissues or bulging of floor of mouth. Temperature 99.4° F., pulse 86, respiration 20. Patient very apprehensive.

On the basis of these signs and the patient's symptoms a diagnosis of gas gangrene of face and neck was made and radical treatment was instituted.

The patient was immediately given 40,000 units of polyvalent anti-gas-gangrene serum. Sutures in gums were removed and drains taken out. Penicillin, 40,000 units, was given intramuscularly and 4 gm. of sulfadiazine given orally (no intravenous sulfa drug available).

At 1650 under sodium pentothal anesthesia a dissection of the neck was performed. Two incisions were made, an anterior one along the anterior border of the right sternocleidomastoid muscle and across the suprasternal notch, and a lateral one from the middle of posterior border of the sternocleidomastoid to the middle of superior border of right clavicle. Incisions were carried through the deep cervical fascia and the trachial rings were exposed anteriorly. Several gas bubbles were encountered in dissection but no gross necrosis of tissue was observed. The wounds were sprinkled with sulfonilamide-penicillin mixture (15 gm. sulfonilamide to 100,000 units of penicillin) and left gaping. A dressing of vaseline gauze loosely applied was covered by 8- by 8-inch gauze. Along with the sodium pentothal the patient received an additional 40,000 units of penicillin intravenously; 500 cc. of whole blood was given at 2300.

In addition to the original anti-gas-gangrene serum the patient received 10,000 units intramuscularly in four hourly doses. For the next 36 hours he received 20,000 units every 4 hours and for an additional 24 hours he received 10,000 units every 4 hours. This gave a total of 320,000 units up to noon of the 27th when his temperature had subsided to normal and when the residual crepitation in the tissues of the right cheek was no longer palpable.

From 27 July the temperature remained normal and on 30 July the sulfadiazine and penicillin therapy were discontinued. A regular medication of penicillin, 40,000 units intramuscularly every 4 hours and sulfadiazine 1 gm. every 4 hours, had been maintained up to that date.

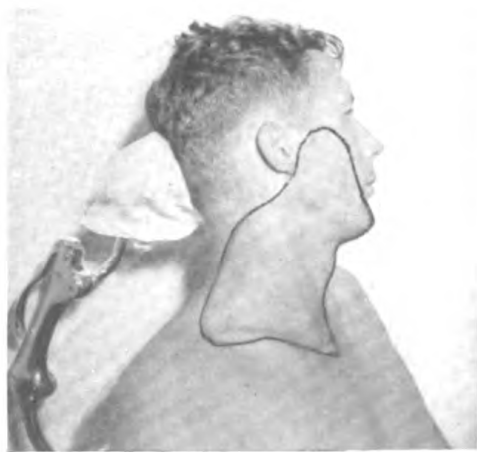


FIGURE 1.

On 7 August secondary suture of the wound was done under sodium pentothal anesthesia and on 10 August the sutures were removed. The patient was discharged to duty 17 August. Pictures (fig. 1) were taken 16 August, the ninth day after secondary suture. (The area of tissue crepitation is outlined in crayon.)

DISCUSSION

Whether the offending organism was of the *Clostridium-perfringens-oedematiens* group cannot be definitely stated as no culture was made, but the considerable gas present in the tissues of

the face and neck was certain evidence of a gas producing anaerobe. Whether the organism was present in the patient's mouth or was deposited through an unfortunate breach of technique cannot be stated.

Undoubtedly the suture of the gums (though loosely) over the drains acted to exclude air from the tissues and facilitate the exceedingly rapid dissemination of the infection. This brings up the question of whether the suturing of pyorrheal gums is a sound practice or not. If the advantages are worth the risk then certainly penicillin or a sulfa-penicillin mixture would appear indicated as a prophylactic instillation. (Our use of this mixture in the naval base hospital in southern England in the treatment of both potential and actual cases of gas gangrene was eminently successful.)



CEREBROSPINAL FEVER COMPLICATED BY EXTENSIVE THROMBOTIC GANGRENE OF THE SKIN AND SUBCUTANEOUS TISSUES, WITH RECOVERY

MORRIS STEINER

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Complications following cerebrospinal fever are not infrequent. These may be due to the disease itself or to the therapy used. In the former condition are listed arthritis, deafness, encephalitis, paralysis, pericarditis, endocarditis, panophthalmitis, otitis media, hydrocephalus and epididymo-orchitis. Complications due to treatment are usually encountered in the use of the sulfonamide drugs. The most important of these are hematuria and urinary suppression.

The case to be presented was featured by an unusual complication due to the disease itself, extensive thrombotic gangrene of the skin and subcutaneous tissue, and the added complication of hematuria and anuria which were attributed to sulfonamide therapy.

CASE REPORT

On 12 January 1945, a 24-year-old white Navy dependent was brought to the family clinic at 7 p. m. with the history that she had awakened at 6 a. m. complaining of headache and fever. Five grains of aspirin were given which relieved the headache but at 5 p. m. she became drowsy and could not easily be aroused. She was then brought to the clinic by ambulance at which time she appeared acutely ill, semicomatose and covered with an extensive spotted eruption on her trunk and extremities. The rash was very marked and appeared

to be confluent over the buttock where it was deep purple in color and had the appearance of extensive subcutaneous hemorrhage. Her temperature was 105° F. orally. Both eyes were chemotic. There was no neck rigidity, Kernig or Brudzinski sign. Heart and lungs were normal, abdominal examination negative. A diagnosis of cerebrospinal fever was made and the patient transferred to the Henry A. Wise Memorial Hospital for Contagious Diseases, Norfolk, Va. Her subsequent course in the hospital is presented through the courtesy of Dr. A. H. Brock.

On admission to the hospital, a lumbar tap was performed. Clear fluid under normal pressure was obtained which had a cell count of 100, mostly all polymorphonuclear cells. Smear did not reveal any organisms. Fifteen thousand oxford units of penicillin were given intrathecally and 5 grams of sodium sulfadiazine intravenously in 100 cc. of sterile distilled water. This was followed by the intravenous administration of 1,000 cc. of 5 percent dextrose in physiologic salt solution. The patient was then started on systemic penicillin, 15,000 oxford units intramuscularly every 3 hours.

The following day the patient was unimproved. The rash was striking by the extensive area that it covered, especially on the lower extremities where several of the ecchymotic areas had coalesced, giving the appearance of dark fluid underneath the skin. She was irrational, coughed up blood several times and had two nose bleeds. Nuchal rigidity was present, Kernig and Brudzinski signs were positive. Blood pressure was 68 systolic and 48 diastolic. It was noted that the patient had voided a small amount of urine during the night but the specimen was not saved. Lumbar tap revealed cloudy fluid under increased



FIGURE 1.—Appearance of lesions on admission to naval hospital 18 days after onset of illness.



FIGURE 2.—Appearance of lesions 3 weeks after admission to naval hospital 39 days after onset of illness.

pressure. The cell count was 23,800, all polymorphonuclear cells. Smear and culture were positive for meningococcus intracellularis. She was then given 5 grams of sodium sulfadiazine intravenously, and 15,000 units of penicillin intrathecally. This dose of sulfadiazine was repeated 6 hours later because of the critical condition of the patient.

On the second evening of admission the patient was catheterized because she had not voided for 24 hours. No urine was obtained. One thousand cubic centimeters of Ringer's solution was given intravenously and 4 hours later 1,000 cc. of 10-percent dextrose solution.

On 14 January, the third day of her illness, the patient appeared to be edematous but was less stuporous. Her temperature had dropped to 100° F. and her blood pressure rose to 80 systolic; diastolic pressure was 28. Neck rigidity was marked, spinal fluid cloudy and positive on smear and culture. Fifteen thousand units of penicillin were given intrathecally and sulfonamides discontinued because of the urinary suppression. Twenty-five hundred cubic centimeters of fluids were given intravenously, 1,000 cc. of Ringer's solution and 1,500 cc. of 10-percent dextrose. On catheterization, 60 cc. of highly concentrated urine was obtained, containing many red and white blood cells and sulfadiazine crystals.

On 15 January, the fourth hospital day, the patient continued to improve and the same treatment given as on the preceding day. The urinary output had increased to 200 cc. of concentrated urine. Blood nonprotein nitrogen was 175

mg. per 100 cc. The spinal fluid was less cloudy but negative spinal fluid cultures were not obtained until 17 January, after 5 days of intrathecal penicillin therapy. From then on, the patient continued to improve steadily, the edema subsided and on 18 January, 6 days after the onset of her illness, she had a normal urinary output. The skin over the ecchymotic areas became thick and black in color, being especially marked on the buttock. The patient was discharged from the Henry A. Wise Memorial Hospital on 28 January, 18 days after admission and was sent to the naval hospital for further treatment because of the extensive gangrenous areas on her buttock and extremities.

On admission to the naval hospital the patient had extensive areas of dry gangrene on the buttock and similar smaller areas on all four extremities and chest (fig. 1). General physical examination was within normal limits, as were blood chemistry, urine analysis, and blood studies.

Treatment consisted in debriding the necrotic tissue and the application of penicillin in a bland ointment base (250 units per gram) to open areas. The lesions granulated in slowly and the patient was able to leave the hospital on 12 March, 2 months after the onset of her illness.

COMMENT

The complication of gangrene due to meningococcal infection is apparently very rare. In 2,623 cases reviewed in the literature between 1942 and 1944 (1) (2) (3) (4) (5) (6) (7) (8) not a single case having this complication was cited. In the case reported, it was felt that the patient had an overwhelming infection manifested by stupor, extensive purpura, hypotension, nose bleeds, and hemoptysis; these symptoms fit into the clinical picture of the Waterhouse-Friderichsen syndrome. Gangrene of the skin and subcutaneous tissue resulted from multiple embolizations of the smaller vessels. The prompt institution of treatment with both sulfonamides and penicillin were probably responsible for the patient's recovery.

Hematuria and anuria in this instance were attributed to the sulfonamide therapy. Thirty-six hours after the administration of 15 gm. of sodium sulfadiazine intravenously, the patient ceased to void. Several factors were operative to produce this condition. Dehydration and ketosis, resulting from diminished fluid intake and high fever produced a highly concentrated acid urine. In addition, hypotension resulted in diminished renal blood flow, accentuating the conditions necessary for precipitation of sulfadiazine crystals.

The incidence of hematuria as noted by various authors is given in table 1. Denny, Bausch, and Turner (8) noted the occurrence of microscopic hematuria in 53 percent of 53 reported cases. Gross hematuria occurred in only 3 cases and in no instance did anuria result. The administration of alkali prior to or concomitant with sulfonamide therapy together with an adequate fluid intake tends to eliminate the danger of renal complications. There is recent evidence to indicate that sulfonamides may produce injury to the kidney tubules

in addition to obstruction of the tubules by sulfonamide crystals (9). Clinical evidence of this may be surmised from the report of Goldring and Hartmann (14) who noted gross hematuria in 11.6 percent and microscopic hematuria in 6.4 percent of 77 reported cases in children. All were given carefully calculated amounts of alkali in the form of Ringer's solution and the fluid intake was adjusted to produce a large amount of diluted urine. No cases of renal obstruction were reported in their first group of cases in spite of doses of sulfonamides sufficient to produce blood levels of 20 to 40 mg. per 100 cc.

TABLE 1.—*Incidence of hematuria reported by various authors following use of sulfonamides in treatment of meningococcus meningitis*

Author	Number of cases reported	Hematuria, gross	Number of cases, microscopic	Remarks
Goldring and Hartmann	77	9 (11.6%)	5 (6.4%)	1 death from kidney complication.
Goldring, Maxwell, and Hartmann	209	17 (8.1%)	15 (7%)	
Taranto	100	3 (3%)		Do.
Newcomer and Frame	50	7 (14%)		
Van Orden and Armentrout	38	3 (7%)	9 (24%)	
Mewborne, Tolpin, and Hirschberg	27	5 (18%)		
Thomas	1,935	(1)		Anuria—1 case; Oliguria—4 cases.
Marangoni and D'Agati	134	11 (8.2%)	17 (12.7%)	
Denny, Bausch, and Turner	53	3 (5.6%)	29 (47.1%)	

¹ Seen occasionally.

It was interesting to note that in 76 cases of meningococcus meningitis reported by Rosenberg and Arling, treated with intrathecal penicillin (10), there were no reported cases of hematuria. In 10 unreported cases treated by the author with penicillin, there was no gross or microscopic hematuria noted. This strengthens the belief that hematuria, occurring in cases of cerebrospinal fever treated with sulfonamides, is a complication of the therapy and not of the disease itself. This is no criticism of sulfonamide therapy but rather an indication that strict attention should be paid to the administration of adequate alkali and fluid intake as advocated by Goldring and Hartmann (14).

Once anuria has developed as a result of sulfonamide precipitation, a trial of intravenous fluids for 48 hours should be given before catheterization of the ureters is attempted. In this case 1,000 cc. of Ringer's solution was given together with 1,500 cc. of 10 percent dextrose every 24 hours for 48 hours, after which a small amount of urine was obtained. The patient became somewhat edematous but once renal function was initiated, the edema subsided within 48 hours. In a subsequent case of anuria due to sulfonamide therapy 50 gm. of human albumin were given intravenously together with the above

therapy. Urinary function was initiated in 24 hours. When medical treatment fails to produce the desired results, catheterization of the ureters is indicated.

CONCLUSIONS

1. A case of cerebrospinal fever with the rare complication of extensive thrombotic gangrene of the skin and subcutaneous tissue is reported.
2. An additional complication of renal anuria due to sulfonamide therapy was also present and responded successfully to intravenous therapy.

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MEDICAL AND SURGICAL DEVICES



MALARIA CONTROL

Description of a Compressed Air Sprayer

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The solution of problems of malaria control on island bases on a postwar, caretaker status which would be consistent with rolling up and concentration of personnel requires adjustment to a more economical organization than that employed during wartime emergencies. After the malariologists, entomologists, and engineers have departed and the task of control falls chiefly on nontechnical personnel, control programs must be streamlined in order to be carried out effectively. As a matter of fact, actual control is effected more by truck drivers with average mechanical ability than by trained malaria technicians.

The changing picture does not permit relaxation in control. On the contrary, the zone can be reduced to only the radius of anopheline flight, and a more rigid discipline must be instituted to prevent out-of-bounds penetration.

The practical solution of this problem was dealt with on this island, 2° below the Equator and in the heart of the malaria belt, by developing a more powerful spray apparatus for DDT in Diesel oil dissemination. It permits a widespread coverage, a reduction in personnel for maintenance, elimination of the necessity for airplane spraying, and permanent control on a routine basis, in spite of daily rains which necessitate weekly spraying of all areas.

With this type of control, with native segregation, mandatory in view of an 80 percent splenic index, and with rigid discipline, suppressive treatment for occupation forces and their families will be unneces-

sary. The peacetime program for control can be aimed at not merely the wartime working goal—permitting operations under suppression of malaria—but rather toward breaking the malaria chain and thereby actually preventing the disease. Atabrine suppression leaves much to be desired and is not feasible as a permanent measure.

With two spray trucks in operation and one in reserve, malaria control can be effectively handled with one officer and six men over areas as large as 30 square miles, the present control zone in the Admiralty Islands.

The two compressed air sprayers now in use at Malaria Control have been recently constructed. No data relative to the effectiveness of such an apparatus were available. In the field tests described in this report it has been our purpose to “measure” the effectiveness of the sprayers by determining the distance over which an insect-killing spray will carry under typical meteorological conditions here in the Admiralty Islands.

Two tests were performed, the first using sprayer No. 1 and a second using sprayer No. 2.

MATERIEL

MOSQUITO LARVAE AND THEIR COLLECTION

First, second, and third instar culicine and anopheline larvae taken from a permanent culture pool were transported to the testing ground in capped beer bottles which had been thoroughly cleaned, washed with tap water, and then with water from the culture pool, in which they were kept until needed for the test. Sterile Petri's dishes were used to contain the larvae during the spray tests. Great care was exercised to avoid contamination of either the beer bottles or the Petri's dishes with DDT, which might be present around Malaria Control.

PREPARATION OF SMOKED GLASS SLIDES

For these experiments 100 glass microscope slides were covered with carbon black, which was generated by means of a kerosene lantern. These smoked slides were carefully packed in slide boxes to prevent contaminating, scratching, dust, etc.

CORRELATIVE INFORMATION

Accessible at the Momote Airfield, where the first test was performed, was an anemometer, which recorded the wind velocity.

The concentration of the DDT used in the test was 5 percent by weight in No. 2 Diesel oil solution.

Distances were calibrated by means of pacing and speedometer and are believed to be accurate enough for all practical purposes.



FIGURE 1.—View of sprayer No. 2 in action, showing nozzle arrangement.



FIGURE 2.—Sprayer No. 2 in action on Water Works Road, Manus Island.

COMPRESSOR APPARATUS USED

Two compressed-air spray trucks are now in operation. Both were designed and constructed by Chief Pharmacist's Mate G. S. Barnett with the assistance of the 1050 Construction Battalion. The first of these sprayers was constructed using a 4 by 4 1½-ton truck and a portable air compressor producing 210 cubic feet of air per minute. Two larvicide tanks, each with a capacity of 275 gallons, are mounted on the truck. Spray nozzles direct spray horizontally.



FIGURE 3.—Sprayer No. 2 in action on Water Works Road, Manus Island. Note upward drift of spray, which coats both under and upper surfaces of vegetation with DDT. Airplane spray usually is deposited on only the upper surface.

The second truck was a 6 by 6 with a 210 cubic foot compressor. The tank mounted for larvicide is of 300-gallon capacity. The spray nozzles have been improved over those on sprayer No. 1, being directed upward at a 45° angle. The improvement in nozzle construction and upward direction of spray have resulted in improved dissemination of spray.

Spray nozzles were constructed of ¼-inch pipe fittings and ½-inch Monel bar stock threaded ¼-inch NPT. The bores were drilled at one chucking in the lathe in order that they be concentric. Main oil and air supply lines should be ¾-inch pipe. Ten of these nozzles were assembled in a gang.

With a 210 cubic foot per minute air supply, 60- to 65-pound pressure is maintained. Oil supply valve is adjacent to driver, allowing one-man operation. Output for this assembly is four barrels of insecticide per hour. At 4 miles per hour, spread of DDT is just over 0.1 pound per acre.

No claim for mechanical efficiency is put forth, but the availability of the parts required and the ease of training personnel in operation make this a suitable spray apparatus for malaria control under a caretaker status.

PROCEDURE AND RESULTS

FIRST TEST

Momote Airstrip was selected as the best location for carrying out the first spray test, first because of its proximity to the anemometer, whereby wind velocity and direction could be measured and recorded, and second because the strip affords adequate flat, open area for a spray test. Wind direction caused difficulty in placing slides, and tests were not as complete as could have been desired (see table 1 for results).



FIGURE 4.—A typical anopheline breeding area on Los Negros Island. Note shade and floating debris.

TABLE 1.—*Results of first spray test*

Distances from sprayer	Average number of oil droplets deposited per square inch ¹	Approximate maximum oil droplet size in microns ²	Approximate minimum oil droplet size in microns ³	Approximate average oil droplet size in microns ⁴	Larvae percent of kill	Time required for kill of all larvae in hours ⁵
50 feet ⁶	Washed				100	2
100 feet ⁶	do.				100	2
150 feet ⁶	do.				100	2
200 feet ⁶	(Too numerous to count.)	1,300	12	568	100	2
250 feet ⁶	do.	1,300	7	315	100	2
300 feet ⁶	do.	1,300	10	203	100	2
350 feet ⁶	do.	1,300	9	174	100	2
400 feet ⁶	do.	1,300	8	151	100	2
450 feet ⁶	do.	1,300	7	153	100	2
500 feet ⁶	451	1,180	8	141	100	2
0.2 mi. ⁷	68	1,151	9	138	100	12
0.3 mi. ⁷	36	622	9	101	100	36
0.5 mi. ⁷	15	196	7	73	60	48

¹ 1 square inch on each slide counted; average taken.² Largest droplet found on any slide at distance given.³ Smallest droplet found on any slide at distance given.⁴ 25 droplets measured; average taken.⁵ Larvae exposed in Petri's dishes beside slides simultaneously.⁶ Truck was driven at right angle to windward of these slides at 3 mph. Wind velocity, 3 to 4 knots, varying from north to west.⁷ Since winds were variable, truck remained stationary with sprayer operating. Slides exposed to spray for 1 minute. Data very meager because of bad weather.

NOTE.—Of 100 control larvae, 2 percent died in 56 hours; 36 emerged as adult mosquitoes.

SECOND TEST

The second test was performed using sprayer No. 2 which was driven at a constant speed of 3 mph on the road leading from Victory Highway to the water works. Estimated wind velocity was approximately 10 knots. Previous to the run of the truck, slides were placed to leeward of a point which the truck would pass at 0.1, 0.2, and 0.3 mile distances. Table of results is shown in table 2.

TABLE 2

Distances from sprayer in miles	Average number of oil droplets deposited per square inch ¹	Maximum oil droplet size in microns ²	Minimum oil droplet size in microns ³	Average oil droplet size in microns ⁴
0.1	688	1,170	9	139.6
.2	52	1,120	9	149.4
.3	60	540	8	95.4

¹ 1 square inch on each slide counted; average taken.² Largest droplet found on any slide at distance given.³ Smallest droplet found on any slide at distance given.⁴ 25 droplets measured; average taken.⁵ This station was subject to fluky wind currents due to hedgelike growth of trees.

COUNTING AND MEASURING THE OIL DROPLETS ON THE SMOKED GLASS SLIDES

The oil droplets were counted on a measured square inch of each glass slide. Micron size and counts were determined with an optical micrometer, using low power on a compound microscope.

CONCLUSIONS

These tests were preliminary. Further tests will be performed as spray equipment is modified and weather conditions permit.

From data gathered in these tests it has been reasonably determined that effective kill of adult and larval mosquitoes, as well as flies, can be expected within 0.3 mile on the lee side of spray apparatus. Reports from Father O'Connell, Catholic missionary at Papitelai, and from N. A. B., Momote, have indicated that flies and other annoying insects, which were very numerous before spraying, have almost totally disappeared. The location of roads makes spraying of nearly all areas on both Los Negros and Manus practical.

Because of the effectiveness of this spray apparatus in controlling larval and adult mosquitoes, large numbers of native laborers will not be required. Airplane spraying of these islands would not be very effective, because wind velocities are normally in excess of 3 knots, and most of the spray would be blown out to sea.



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(For review)

AN ATLAS OF THE COMMONER SKIN DISEASES, by *Henry C. G. Semon, M. A., D. M. Ozon., F. R. C. P.* London, *Physician for Diseases of the Skin and Lecturer to Postgraduates, Royal Northern Hospital.* 3d edition. 343 pages; 139 plates reproduced by direct color photography from the living subject. Photography under the direction of Arnold Moritz, B. A., M. B., B. C. Cantab. The Williams & Wilkins Co., Baltimore, Md., publishers, 1946. Price \$12.

This is an excellent atlas, the purpose of which is to portray from the living subject, and in natural color, a collection of dermatoses most frequently seen. Dermatology (which perhaps more than any other field in medicine is dependent upon keen and detailed visual inspection for the formation of visual pictures) welcomes another edition of this book. It ably serves the chief function for which such an atlas is designed—that of assisting the visual memory in forming accurate associations to disease processes of the skin and its appendages.

The choice of skin diseases which are depicted is good. All of the common dermatoses to be found in temperate climates are shown. In the case of certain conditions which may take various forms, pass through different stages, or have varied distributions (e. g. psoriasis, lupus erythematosus, eczema, syphilis, etc.) there are several plates for each disease.

There are 139 colored plates reproduced in this volume. All are full-page illustrations reproduced by direct color photography, and are accompanied by text. The first 120 illustrations represent the more common diseases of the skin and are arranged in alphabetical order,

whereas the last 19 reproductions are concerned with the more rare cutaneous ailments, and have no alphabetical arrangement.

Earlier atlases showed the difficulty of portraying the delicate tints to be found in normal and pathological skin. However, the majority of the dermochromes in this atlas approach perfection. The subtle tints of normal skin and the pinkish, reddish, and purplish nuances of cutaneous pathological states have been beautifully captured by the photographer working with color film. The characteristics of the individual skin lesions have not escaped—for silvery scales appear silvery, crusts look like crusts, papules rise like papules, and the vesicles glisten like vesicles—one gets the “feel” of the lesion and the skin, as well as the picture. Due to the large number of excellent plates, it would be unwise and unfair to single out certain of the dermochromes which are particularly meritorious, as the list would be a long one.

The text consists of abbreviated clinical descriptions, occasional notes on particularly interesting or significant histories, the differential diagnosis where considered essential, and brief outlines of treatment. The arrangement is a convenient one, the explanatory text being on the left, facing the accompanying dermochrome on the right. An occasional reference to the current literature is given. A minor criticism, or perhaps an inconvenience, is that occasional drugs are mentioned which are British proprietary or experimental pharmacological preparations and will not be found in the U. S. Pharmacopoeia.

This is a beautifully bound book, well printed with both text and plates on highly glossed paper.

This atlas will prove a useful guide in the diagnosis of the more prevalent dermatoses. It should find a welcome place not only among those who specialize in dermatology, but in the medical libraries serving all medical officers who are called upon to diagnose and care for diseases of the skin.

A TEXTBOOK OF CLINICAL NEUROLOGY, by *J. M. Nielsen, B. S., M. D., F. A. C. P.*, Associate Clinical Professor of Medicine (Neurology), University of Southern California. 2d edition, revised. 699 pages; 190 illustrations. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1946. Price \$7.50.

This is a welcome revision of a valued textbook. The field of clinical neurology is covered in a clear, concise manner eliminating much that is controversial and that serves only to confuse the student or discourage the non-neurologist who yet appreciates the importance of keeping in touch with the vast field of clinical neurology.

While the author pays subtle homage to the old dual system of “body” and “mind” at a few points in the book, in general he emphasizes the frequent coexistence of “functional” and “organic” symptoms and points out the indistinct borderland between them.

CLINICAL HEMATOLOGY, by *Maxwell M. Wintrobe, M. D., Ph. D., Professor of Medicine, University of Utah, School of Medicine, Salt Lake City, Utah.* 2d edition. 862 pages; 197 engravings and 14 plates, 10 in color. Lea & Febiger, Philadelphia, Pa., publishers, 1946. Price \$11.

Dr. Wintrobe's second edition sets a standard for revision and bringing textbooks up to date. This book is remarkable for the following reasons:

1. It is really comprehensive and up to date.
2. The author is really an authority in the field.
3. The bibliography at the end of each chapter is excellent.

Each phase of hematology is considered as a dynamic, living subject. In orderly fashion history, physiology, pathology, etc., is woven together and is well illustrated by photographs and charts. The author, an acknowledged leader in hematologic research, presents all sides of debatable subjects faithfully and honestly without dogmatically asserting his own ideas that may be in conflict with others.

The sections on folic acid and nitrogen mustards are well presented and demonstrate their proper positions in the field of therapeutics. This book clarifies their use and value at a time when misunderstandings are still common.

The sections on technique allude to the inherent errors of blood.

The sections on hemolytic anemias, Rh factor, and the relationships of M, N, and P factors, etc., to transfusion reactions is timely and demonstrates the uncertainty of the universal donor, a subject on which there has been so much confusion, and misunderstanding.

The sections on technique allude to the inherent errors of blood determinations but do not emphasize the great element of chance error from an isolated blood count.

In general the book is very scholarly and pleasingly written by one who is interested in the laboratory, who is a capable research worker, and who as a real clinician has the ability to tie all three phases into an excellent useful text for teaching and clinic use.

A PRIMER FOR DIABETIC PATIENTS, by *Russell M. Wilder, M. D.* 8th edition. 193 pages; 8 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$1.75.

This handbook, although primarily for the diabetic patient, is also of value to the physician in the management of a diabetic. It contains information for the patient as to the possible etiology of diabetes, the various urinary tests, the various types of insulin and their usage, complications and how to guard against them. The section on diets includes sample diets.

Especially valuable is the chapter on substitutions for foods in the standard diets, and the recipes, both of which enable a patient to

prepare a palatable, less monotonous diet. Included in the book is a normogram for use in computing the caloric requirements of the individual patient. Following each chapter is the questionnaire for the use of the patient in his study of diabetes.

As mentioned in the preface, the primer is the substance of the instruction given in the Diabetic School at the Mayo Clinic. While brief sections are for the physician, medical terms generally are avoided. The book is addressed to the patient working under the guidance of his family physician.

NUTRITION AND DIET THERAPY, by *Fairfax T. Proudfit, Instructor in Nutrition and Diet Therapy, University of Tennessee College of Medicine*. 9th edition. 782 pages; numerous illustrations. The Macmillan Co., New York, N. Y., publishers, 1946. Price \$3.75.

A textbook of nutrition and diet therapy, primarily for students in dietetics. It develops its subject from a discussion of proteins, carbohydrates and fats through energy requirements, vitamins, and metabolism before discussing diets. A new section on the preservation and safeguarding of foods has been incorporated in this edition. The second section is devoted to special diets for pregnancy, lactation, and children, with an added section on the feeding of the aged.

This book tends to fewer special diets and places emphasis on the well-balanced regular diet, modified to meet certain individual variations. It is of value especially to the student and practicing dietitian. It is of use to the physician as a handy reference for aid in dietary therapy and problems.

The last section of the book covers such subjects as recipes and elementary cooking and in the appendix are comprehensive tables regarding the composition of foods.

ELECTROCARDIOGRAPHY IN PRACTICE, by *Ashton Graybiel, M. D., Capt. (MC) U. S. N. R., Coordinator of Research, U. S. Naval School of Aviation Medicine, Pensacola, Fla., and Paul D. White, M. D., Lecturer in Medicine, Harvard Medical School; with the assistance of Louise Wheeler, A. M., and Conger Williams, M. D., Assistant in Medicine, Harvard Medical School*. 2d edition. 458 pages; 323 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$7.

The second edition of this well-known work on clinical electrocardiography has essentially the same style and format as the original edition. It appears to be particularly successful in the presentation of electrocardiographic material.

The first part on physiological principles and technique presents the well-established data on axis and limb leads and in addition, furnishes an excellent discussion of more recent information on vectors and precordial leads. Particularly noteworthy is the section on the choice of indifferent electrodes with chest leads.

In part two, variations of the normal electrocardiogram are discussed. This part has been expanded to include more examples of normal tracings and therefore furnishes a broader base for the beginner in this field.

Part three on the arrhythmias demonstrates all the important variations in rhythm without becoming an exhaustive catalog of all the minor varieties. Explanations of the mechanisms cover the fundamentals but are not unduly technical.

Part four covers the etiologic types and patterns. There are, in addition to the discussions of intracardiac causes, concise presentations of a wide variety of conditions which from time to time, vary the pattern of the electrocardiogram.

The final part contains a number of selected exercises for practice in interpretation. The authors have included at various points, tables which summarize their discussions. These are particularly useful for quick reference. This work continues to be one of the outstanding books in the field of electrocardiography for the physician who desires a comprehensive presentation rather than an exhaustive study.

TEXTBOOK OF PSYCHIATRIC NURSING, by *Arthur P. Noyes, M. D., Superintendent Norristown State Hospital, Norristown, Pa., and Edith M. Haydon, A. M., R. N., Superintendent of nurses, St. Elizabeths Hospital, Washington, D. C.* 4th edition. 396 pages; 28 illustrations. The Macmillan Co., New York, N. Y., publishers, 1946. Price \$3.

This edition is a suitable textbook for the 3- to 4-month course in psychiatric nursing required for nurses by State registration boards.

It presents the extent and variety of mental ill health clearly and concisely. Chapters on treatments are excellently prepared for practical demonstrations. The step-by-step procedures are discussed and illustrated.

Throughout the book the appeals for sympathetic understanding care for the mentally ill, the need for constant vigilance, the importance of resisting maudlin emotion, are repeated. The young nurse will find the glossary at the end of the book helpful. Without definitions, early lectures in elementary psychiatry can be vague.

The advantages of a course in psychiatric nursing is stressed and its value in meeting life's problems, both personal and professional, is pointed out.

This fourth edition of the well-known textbook of psychiatric nursing maintains the standards of former editions and includes the latest concepts of mental diseases and their treatment.

ACRYLICS, by *Stanley D. Tylman, M. S., D. D. S., Professor of Prosthetics and Head of Crown and Bridge Department, University of Illinois, College of Dentistry, Chicago, Ill., and Floyd A. Peyton, Ph. D., Assistant Professor of Dentistry, Department of Metallurgy, University of Texas, School of Dentistry, Houston, Tex.* 480 pages; 440 illustrations (2 plates in color). J. B. Lippincott Co., Philadelphia, Pa., publishers, 1946. Price \$10.

In presenting this book the authors have gone to a great deal of effort in reviewing the innumerable articles in the literature. Because of this fact the book is not only valuable as a reference but also because of its bibliography and listing of supplementary reading.

There are two parts to the textbook. Part one deals with the history of synthetic dental resins and related materials—their chemical and physical nature. The chapter on processing methyl methacrylate should be of definite value to both the practicing dentist and the laboratory technician. Part two gives the clinical application of synthetic resins to crown and bridge, complete dentures, partial dentures, and somatoprosthesis. The applications to dental usage and various techniques is an excellent presentation of the material. The section on somatoprosthesis is, however, a sketchy review of various techniques, some of which are already outmoded.

THE EYE MANIFESTATIONS OF INTERNAL DISEASES, by *I. S. Tassman, M. D., Associate Professor of Ophthalmology, Graduate School of Medicine, University of Pennsylvania, Philadelphia.* 2d edition. 614 pages; 243 illustrations including 24 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1946. Price \$10.

The second edition of this well-known book is arranged in essentially the same manner as the first edition. A concise review of the anatomy of the eye is presented first, followed by illustrated descriptions of most of the common diseases of the eye.

The book was written in an attempt to bridge the gap between the eye manifestations and the other more generally known clinical manifestations of internal diseases. It serves admirably as a ready reference work for the medical man who examines the eye as part of his general examination of the patient.

The publishers are to be congratulated on the fine format of the book.

EARLY AMBULATION AND RELATED PROCEDURES IN SURGICAL MANAGEMENT, by *Daniel J. Leithauser, M. D., F. A. C. S.* 230 pages; 42 illustrations. Charles C Thomas, Springfield, Ill., publishers, 1946. Price \$4.50.

We have all heard a great deal about early ambulation during the past 2 years; and perhaps most of us have shortened the postoperative bed rest by various degrees. Therefore, Dr. Leithauser's book is appropriate at this time.

This book is designed mainly to introduce to the surgeon a new trend of thought and practice on a rationale basis.

The author feels that the results of surgery can be fairly judged on five objective criteria. These are: (1) percentage of cases with post-operative complications, (2) percentage of postoperative deaths, (3) length of hospital stay, (4) date of return to work, and (5) results as determined by follow-up investigation. He presents 2,047 early ambulatory cases to be judged by these criteria. Eight hundred forty of these patients were out of bed in 3 to 5 hours after surgery; and the postoperative complications were few in comparison to those that occurred with the conventional postoperative treatment. The complications included pathology of the pulmonary gastro-intestinal and circulatory systems.

His explanation for the lack of occurrence of these complications seems logical in that he states that he interfered as little as possible with the natural body functions. This, of course, implies early ambulation which in turn requires careful dissection, careful use of drains and suitable suture material. Part of the book deals therefore with proper incisions, drainage, and suture materials.

This text presents a radical departure from conventional surgical methods, but it is valuable to the surgical profession for its clear, practical, and logical presentation.

DISORDERS OF THE BLOOD, by Sir Lionel E. H. Whitby, C. V. O., M. C., M. A., M. D. (Cantab.), F. R. C. P. (Lond.), D. P. H. *Regius Professor of Physics in the University of Cambridge; Honorary Consulting Haematologist to the Army; and C. J. C. Britton, M. D. (New Zealand), D. P. H., Assistant Pathologist, the Blund-Sutton Institute of Pathology, The Middlesex Hospital; Pathologist, The Samaritan Free Hospital for Women; Officer in Charge, Public Health Laboratory, Sector V.* 5th edition. 665 pages; 15 plates, 10 in color, and 71 text figures. The Blakiston Co., Philadelphia, Pa., publishers, 1946. Price \$10.

In this fifth edition, the authors have brought up to date an authoritative textbook on blood disorders.

The text begins conventionally but logically with an excellent presentation of the embryology, histology, physiology, and pathophysiology of the blood, as well as a critical evaluation of certain controversial aspects of these subjects. Most of the book, however, is devoted to the clinical aspects of hematology, which are covered comprehensively and with facile readability.

Particularly worthy of mention is the exceptionally clear exposition of present conceptions concerning blood coagulation, bleeding time, factors controlling the erythrocyte sedimentation rate, the Rhesus factors; the etiological classification of anemias; the newer knowledge pertaining to hemagglutination and blood transfusion.

The text is well arranged, and there is a considerable number of helpful and practical diagrams, outlines, graphs, and illustrative plates. The final chapter, which is not overextensive, deals with laboratory technique. Not the least of this book's praiseworthy features is the presence, at the end of nearly every chapter, of a concise summary, stripped of the controversial views of different schools of thought.

This splendid volume would make a valuable addition to the private library not only of the hematologist (especially for its extensive bibliography), but of the pathologist, internist, and general practitioner as well.

ROOT CANAL THERAPY, by *Louis I. Grossman, D. D. S., DR. Med. dent.* 2d edition, thoroughly revised. 354 pages; illustrated with 94 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1946. Price \$5.50

This second edition has been revised to include the newer concepts and methods of treatment in root canal therapy. The pathology, diagnosis, and treatment of pulp and periapical disease are clearly and concisely discussed. The relation of pulpless teeth to focal infection is brought into proper perspective, in view of recent investigations.

The selection of cases for treatment, various methods of preparing the root canal, sterilization of the canal, and root canal filling materials are all comprehensively presented. The use of the newer antibiotics in root canal therapy is also discussed.

This work gives a clear, comprehensive picture of the root canal problem and offers a sound guide to better and more successful root canal therapy.

HYGIENE, by *Florence L. Meredith, B. Sc., M. D., Fellow of the American Medical, American Public Health, and American Psychiatric Associations; Professor of Hygiene and Public Health, Tufts College.* 4th edition. 838 pages; numerous illustrations. The Blakiston Co., Philadelphia, Pa., publisher, 1946. Price \$4.

The book is quite inclusive, presenting a multitude of data, facts, and opinions on practically every aspect of hygiene. In all chapters the material is presented in a clear, concise, and easily understandable manner. The material is of a nature in which most of us are interested—our own well-being in health and disease. The book has been written for the college level and as a reference text for student and graduate nurses and Hospital Corps personnel. The first three chapters are more or less introductory for the discussions which follow in the rest of the book. Dealing first with general health information of the nation and certain trends, followed by chapters on anatomy and physiology of the body in health and disease along with a brief

history of the development of preventive medicine and hygiene. The remainder of the book is devoted to the actual field of hygiene, both personal and public, with emphasis on the former. Some of the newer discoveries in the field of medicine and hygiene are touched on lightly such as newer chemotherapeutic agents, penicillin and streptomycin, etc.

It presents logical and practical advice on many problems pertaining to health and hygiene. It is recommended for those groups mentioned.



PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



REPORT OF INVESTIGATION OF HEALTH HAZARDS IN CONNECTION WITH THE INDUSTRIAL HANDLING OF THALLIUM

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and

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Thallium was discovered in 1861 by William Crookes. It is a silvery-white, soft, malleable metal similar to lead, and has long been known to possess definite toxic properties as shown by Lamy in 1863.

Its salts have had various uses in medicine, and in industry as a depilatory, in alloys as a chemical catalyst, rodenticide, insecticide, fungicide, in photoelectric cells, in glass manufacturing, dye and color manufacturing, and the manufacture of fireworks.

MATERIALS AND PROCESSES

This report is made as a result of a request of the Bureau of Ships, U. S. Navy, to investigate the potential health hazards involved and make recommendations as to precautions to be taken in the production of lenses and windows from fused halides of thallium. The work has not progressed in this country beyond the experimental stage.

The processes and materials involved, so far in this experimental work as related by Mr. Phelps of the National Bureau of Standards are approximately as follows:

(a) Impure salts of thallium of whatever nature that can be obtained such as the acetate, sulfate, halides, etc., are purified by precipitation as the sulfate using sulfuric acid. This purification process may be done in various ways using nitric acid, hydrogen sulfide, or sulfur dioxide. The usual method is by the use of sulfuric acid.

(b) The purified thallium sulfate (or nitrate) is then dissolved in hot water and the thallium is precipitated as the halide by the addition of potassium bromide, potassium chloride, or potassium iodide.

(c) The pure halide is dried under vacuum with or without the application of heat.

(d) The halides are then weighed and mixed in the desired proportions.

(e) The mixture is then placed in a suitable crucible and melted in a furnace at between 400° and 450° C., the usual mixture of the halides requiring generally about 412° C. Fumes begin emanating from the crucible when the temperature approaches 200° C. and continue while the material is in the molten state. This melting process may also take place in a sealed off glass bomb in which case no fumes are released.

(f) The molten material is allowed to cool gradually over a period of several days in order that one large usable crystal may be obtained. It may then be cut into desired shapes by the use of a hacksaw, diamond wheel, or file.

(g) While the final process of grinding and polishing was not observed, it is presumed that the rough grinding will be a wet process employing water possibly as the wetting agent, while the final polishing will be done with the use of pitch lined polishing moulds and rouge or hand polishing with rouge.

ROUTES OF ABSORPTION OF THALLIUM IN INDUSTRIAL EXPOSURES

Industrially thallium compounds may be absorbed in three ways. These, in their probable order of importance, are by inhalation of dusts and fumes, absorption through the skin during and after the handling of the compounds in whatever physical state, and ingestion through contaminated food or hands as may occur when individuals indulge in smoking and eating during the handling of these toxic materials in which case they inadvertently bring minute quantities of the material to their mouths.

It is anticipated that these modes of entry of thallium compounds into the body will be involved in both experimental and mass production of thallium halide crystals.

Measures to minimize absorption by these routes should be instituted in industrial operations. These measures consist of good personal hygiene, cleanliness of working environment, adequate ventilation to reduce the concentration of the contaminate in the working atmosphere, and protective clothing and devices.

TOXICITY OF THALLIUM COMPOUNDS

Thallium is a toxic substance having a cumulative effect. It is not quickly eliminated from the body and, therefore, absorption of sub-

toxic quantities can build up to a toxic quantity over a period of time. It is considered to be more toxic than lead and almost as toxic as arsenic.

Many cases of medicinal, accidental, homicidal, and suicidal thallium poisonings, with some fatalities, have been reported in the literature. Munch found 12 cases of industrial poisoning with no fatalities in the literature prior to 1934. Medicinal poisoning has resulted from oral use of the salts, and from local application to the intact skin when used as a depilatory.

In 1938 Iljen, Hofman, Melnikow, and Avestisian studied various thallium salts and found them to be of about the same degree of toxicity. The minimal fatal dose was found to be 14 to 18 milligrams per kilogram of body weight when calculated as metallic thallium.

Children tolerate larger therapeutic doses of thallium compounds than adults, presumably because of the effects on the endocrine glands which in children have not undergone the changes of adolescence and adulthood.

No probable safe concentration of thallium in the atmosphere has been adopted. The probable safe concentration of lead in the atmosphere is 1.5 milligrams of lead per 10 cubic meters of air. That for arsenic has been adopted as 5 milligrams of arsenic (as the trioxide) per 10 cubic meters of air. Inasmuch as thallium toxicity is considered to lie between lead and arsenic, it is the opinion that the probable safe concentration as adopted for lead should be strived for in the case of thallium.

SYMPTOMS OF THALLIUM INTOXICATION

The symptoms and their severity vary with the dose and individual susceptibility. The latter depends upon age, sex, weight, general constitutional condition, idiosyncrasy, etc. Poisoning may result from accidental ingestion, overdose in therapy, and by occupational exposure.

Overexposure in industry may result in gastro-intestinal symptoms, such as loss of appetite, dryness of the mouth, burning of the tongue, gingivitis, stomatitis, nausea, vomiting, and diarrhea followed by constipation. Other toxic effects frequently observed are fatigue, pain in the limbs, falling out of the hair, severe eye affection, inflammation of the kidneys, albuminuria, polyneuritis, lymphocytosis, and eosinophilia. Dermatologic disturbances have been reported such as erythemas and other rashes. Symptoms referable to injury of the central nervous system including restlessness, sleeplessness, drowsiness, excitement, and dementia have been observed due to therapeutic overdosage.

In chronic poisoning the point of attack of thallium appears to be the autonomic nervous system, particularly the sympathetic, which causes falling out of the hair, cataract, inhibition of growth and of sexual development, skeletal disorders (simulating rickets), diseases of the thyroid, parathyroid, sex and suprarenal glands, and other symptoms.

TREATMENT OF THALLIUM POISONING

There is no known certain specific treatment for thallium poisoning. In case of ingestion emetics should be given to remove thallium from the stomach to prevent further absorption, or preferably the stomach should be washed out and large quantities of milk given. More definitive treatment would be to wash out the stomach and give high colonic flushings with water containing 4 grains of calcium sulfide to the pint of water. General supportive measures should be instituted.

Attempts have been made to fix the thallium in the body by the administration of sodium iodide, and promote elimination by the intravenous administration of sodium thiosulfate. Based on the treatment of cases and animal experiments, the most promising therapeutic agent seems to be sodium thiosulfate in the dosage of 1 gram intravenously once or twice daily.

The possibility of the use of BAL as a specific must await further experimental work.

At the first sign of chronic thallium poisoning due to overexposure in industry, the worker should be immediately removed from further exposure.

RECOMMENDED PRECAUTIONS FOR INDUSTRIAL EXPOSURES

1. *Medical Control.*—

(a) **Preplacement physical examinations:** Persons suffering from renal or hepatic disease, anemia, blood dyscrasias, hypertension, alcoholism, chronic infections, or endocrine gland dysfunction should not be exposed to thallium absorption.

(b) **Periodic recheck examinations.**

(1) Based on symptoms reported among plant workers involving an exposure to thallium, workers handling thallium should undergo periodic examinations with particular attention being paid to the functioning of the kidneys, albuminuria, and casts, examination of the eyes, noting changes in the eye background, decreased visual acuity, the blood picture (lymphocytosis, eosinophilia), the presence of pain in the limbs, and falling out of hair. The presence of any of these should contraindicate further exposure.

(2) The interval for performing physical examination, urinalyses (including thallium determination when indicated), and blood counts would depend upon the degree of exposure. In experimental work as now done, provided proper engineering and personal hygiene precautions are taken by personnel acquainted with the hazards involved, an interval of 1 year may be adequate. If mass production is undertaken, it is recommended that a survey of the working environment be made to evaluate the degree of exposure. The examination interval would then depend upon the findings of the survey.

2. *Engineering Control.*—

(a) Sufficient ventilation to keep the concentration of thallium in the air to a minimum should be supplied. No probable safe concentration of thallium in the atmosphere has been adopted, but inasmuch as the toxicity of thallium is considered to lie between lead and arsenic the accepted standard of 1.5 milligrams of lead per 10 cubic meters of air should not be exceeded in the case of thallium until a standard for thallium is accepted.

(b) Furnaces that allow fumes to escape should be exhausted to remove fumes from the breathing zone.

(c) General ventilation necessary to dilute dust and fumes as indicated in paragraph (a) should be provided.

(d) Enclosed processes should be used wherever possible.

3. *Clothing.*—(a) Workers should be required to change from street clothes to work clothes upon reporting to work, and change back to street clothes upon leaving work.

(b) Double lockers should be provided, one for work clothes and the other for street clothes.

(c) Work clothing should be washed at least weekly.

4. *Personal protective equipment.*—

(a) Rubber, or similar gloves should be worn while handling or mixing thallium compounds, and while grinding, polishing, or cutting of thallium halide crystals.

(b) Respirators approved by the U. S. Bureau of Mines for the purpose should be worn in all operations which produce dust or fumes. Each worker should be provided with his individual respirator bearing his name and check number.

5. *General hygienic measures.*—

(a) All workers exposed to thallium should be informed that they are working with a toxic substance and advised as to the proper precautions to prevent poisoning. They should be instructed to report any unusual symptoms to their immediate supervisor, or doctor. Upon reporting to the doctor any unusual symptoms he should inform the doctor of the nature of his work.

(b) Good housekeeping should be practiced at all times regardless of all other methods in practice to reduce exposure. Dust of thallium compounds should not be allowed to accumulate in the working area.

(c) Workers should pay attention to personal cleanliness. The teeth should be brushed at least daily after work. There should be thorough washing of the hands and face before eating and after work. They should shower and change clothes as soon as possible upon leaving work.

(d) A full meal should be eaten before going to work. The presence of food in the stomach helps to prevent the absorption of metals.

(e) Food should not be taken into the working area, and eating and drinking in the workroom must be avoided. Smoking, chewing tobacco and chewing gum while at work must not be permitted. Alcoholic beverages should be avoided.



LONG-TERM OBSERVATION OF PLASMODIUM VIVAX MALARIA IN THE RETURNED SERVICEMAN*

Part II

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RELAPSES

The exact mechanisms underlying malaria relapse are not clear. It probably involves complex interrelationships between the individual host, the strain of the parasite, the degree of infection, and various external factors such as trauma, exposure, etc. There appears to be general agreement among those who have observed cases for long periods that malaria due to *Plasmodium vivax* occurring in returned servicemen is prone to relapse; and the number of relapses are far

* This is the second of the three parts in which this article is being published. The third part will appear in the next issue of the BULLETIN.

greater than anything described in the standard textbooks written prior to the present experience of a large body of nonimmune hosts entering highly endemic areas. Anyone observing these patients for the first few months of their clinical course only, is very apt to draw the conclusion that he is dealing with a highly virulent type of malaria, the like of which has never been seen before and the final outcome of which no one knows. As a result of incomplete observation, there has grown among both medical and lay personnel a conviction that "South Pacific malaria" spells a long, if not permanent, disability. As a result of more than 2 years' careful observation of several hundred cases of "South Pacific malaria" certain facts which oppose this hypothesis have become clearly established.

It seems to be true that some individuals become chronic relapsers but unfortunately, the authors have no valid statistics as to how many out of those originally exposed to malaria do so. Only those who relapse frequently are seen, while most of those who develop only a few relapses either treat themselves or are treated in an ambulatory status. Despite this, numerous records of individuals who have suffered only 1 to 4 relapses over the past 2 years were obtained, although as far as could be determined from their service records, the place and degree of exposure were identical with the group of chronic relapsers who suffered up to 20 proved relapses. This fact of markedly different clinical courses in persons apparently exposed under identical conditions seems to point to unknown individual factor or factors as the important element in the future clinical course of malaria. Additional evidence in favor of this are the records of several cases of *P. vivax* malaria acquired in the Mediterranean, Caribbean, and China areas that have shown repeated relapses. Thus the characteristic of frequent relapses is not solely confined to the "South Pacific strain."

In addition, if only those cases are selected that have been observed personally in two or more relapses and have been out of the endemic malaria areas and off suppressive quinacrine therapy for more than 1 year, certain definite characteristics begin to appear. First, there is a lengthening of the period between relapses; where relapses occurred every 4 to 6 weeks, this period is gradually lengthened to 4 to 6 months. Second, these patients begin to tolerate malaria a great deal better and whereas formerly they were severely prostrated during the acute attack, they now suffer only mild discomfort and inconvenience, walking about and attending to their usual duties. Third, these late relapses respond to very small amounts of antimalarial therapy, or even to analgesic or sedative therapy. It is not infrequent that a case is admitted with a history of a chill and temperature rise to 103° F., with a positive malarial smear prior to admission and upon arrival here, repeated malarial smears are negative and the patient continues to

improve and becomes afebrile in the absence of antimalarial therapy. Many cases give a history of having taken one to three quinacrine dihydrochloride (atabrine) tablets (0.1 to 0.3 gm.) prior to admission and this amount of drug had been sufficient to cause remissions. In other cases, however, only aspirin or phenobarbital had been taken for the headache symptom, yet spontaneous remission occurred. More and more frequently the statement is heard from this type of patient that he "sweats it out" for 1 day and the malaria "leaves him." This behavior is in marked contrast to that state of affairs existing in these same individuals a year or more previously. This is particularly noted in that group of Guadalcanal veterans of August-December 1942, the large majority of whom freely admit that now, 3 years after their first attack, malaria presents no problem to them. However, occasionally one of this group is admitted with a severe relapse, the malaria to all intents and purposes still as active now as 3 years ago; so some instances of persisting severe relapses will be encountered more than 3 years after the return of the last infected servicemen. It is emphasized, however, that this is the exception; and that observations of the cases followed for two or more relapses, show an unmistakable trend toward less severity and a lengthening relapse interval. This is in agreement with the experience of others (1).

If from the records made the general relapse interval of arbitrarily selected groups observed in two or more relapses is calculated, certain significant results are obtained. Fifty-six men who were in this country for 5 months or less were observed for a total of 7,963 man-days. They suffered 135 relapses during this period, with an average of 58.9 days between relapses. Twenty-eight men who were in this country for 6 months were observed for a total of 3,847 man-days. They suffered 93 relapses with an average of 59.1 days between relapses. Nineteen men who had been in this country for 7 to 12 months were observed for a total of 3,114 man-days. They suffered 59 relapses with an average of 77.8 days between relapses.

These average figures suggest that the relapse interval does not begin to lengthen appreciably until the patient has suffered from malaria for at least 6 months. There are noted, also, certain tendencies which are worthy of individual mention. First, there appears to be a certain basic rhythmicity to the relapse interval once it becomes established. This period in days is approximately the same or a multiple of the basic rhythm, from one clinical attack to the next one. Second, there is sufficient variation of this rhythmicity so as to make unpredictable the approximate relapse date of any one individual.

Out of any large group infected with *P. vivax* one would expect the following clinical patterns to develop:

a. Certain cases will have a long interval between relapses at the start of their clinical course followed by a very short interval for the next paroxysm, whereas others may start with a short relapse interval and then go a long time until the next relapse. The records in this study show that a period of as long as 230 days may intervene between the second and third or first and second attacks.

b. Many cases will start right out with a short relapse interval of 4 to 6 weeks and continue this for at least 6 months. The majority of this type will begin to lengthen the relapse interval following 12 months, but an occasional case will go on relapsing regularly up to 3 years following exposure. This statement is based on a few cases that were originally exposed in Guadalcanal in August 1942 to January 1943, and yet almost 3 years after evacuation, still relapse frequently. This type of case is unusual and constitutes less than 1 percent of the whole group. It is emphasized that the authors' experience has been that in the vast majority of cases clinical attacks are less frequent and less severe as time passes over 1 year. Up to 1 year, there appears to be little change in severity from the first attack compared to the last.

The exact time when a given case of vivax malaria will relapse is popularly supposed to depend on intrinsic factors, a sort of maturation process of the parasite within the body, and extrinsic factors such as cold, hunger, fatigue, trauma, alcohol, etc. In the authors' experience in this study external factors played little, if any part in producing a relapse, but it was realized by all working with the problem, that if a method could be found that could be depended on to produce a relapse in any desired case, then a very potent investigative aid would exist. In addition to this, it would materially reduce the hospital days spent by patients who had to be observed for varied periods of time because of transient parasitemia or because they felt subjective symptoms of an impending relapse. There was an additional theoretical point. It might be possible that repeated, *treated* relapses might eventually exhaust the supply of "exo-erythrocytic" tissue forms that are supposedly responsible for relapses in adequately treated malaria. With this in mind, therefore, the effect of reputed important extrinsic precipitating factors upon known cases of relapsing vivax malaria was observed as follows:

1. *Surgery and infection.*—Numerous tonsillectomies, 3 appendectomies, several cases of pneumonia and other infections were allowed to run their course without antimalarial treatment, and no case was observed to be precipitated into a relapse.

2. Five patients were exposed to *erythema doses of ultraviolet light*.

3. Three patients were given *deep x-ray therapy* to the spleen in the amount of 600 r.

4. *Adrenalin*, 1 cc. of 1:1,000 solution was given *subcutaneously* in 10 cases.

5. One patient was given a course of *desoxycorticosterone injections*.

6. Two patients were given an *infusion of 1,000 cc. of physiologic saline solution* via the sternum.

7. Six patients were given daily *diathermy to the spleen* for 7 days.

8. Three patients were *immersed in an ice cold bath* to limit of tolerance and allowed to shiver violently in cold room.

9. *Administration of penicillin* to 2 patients in maximum dosage of 8 million units each.

10. *Calcium panthothenate*, 45 grains given daily for 7 days to 7 patients.

11. *Ketogenic diet plus 60 grains daily of ammonium chloride* for 7 days was given to 4 patients.

12. Four patients were put in *pressure chamber* and brought up to 18,000 feet altitude for 5 hours.

13. *Increase in carbon dioxide content of sealed compartment*.—Four patients were placed in a sealed compartment for 48 hours. The temperature of the room was kept relatively constant at 25.5° to 26.5° C. The content of carbon dioxide was 3.2 percent at the start of the experiment, and was allowed to rise slowly to 5.3 percent by the twenty-third hour where it remained for the last 24 hours of the experiment. During this period of observation the oxygen fell from 20.29 percent at the beginning to 17.4 percent near the end.

14. Four patients, including one with asymptomatic parasitemia, received *gradually increasing insulin up to 100 units daily* for 14 to 21 days with periods of hypoglycemia allowed to continue from 3 to 4 hours before administration of dextrose.

All of the foregoing attempts to precipitate clinical relapses of malaria were ineffective. In addition to these, a group of 77 patients was placed on daily morning hikes of 10 miles, under noncommissioned officer supervision, with strenuous athletic competitions in the afternoons. This exercise regime was carried out in all types of weather: cold, hot, rain, and snow. This exercise group was carefully followed for 4 months at least, and compared to a group not on exercise, but equivalent with respect to parasite and clinical relapse. Rather than precipitate relapses, the exercise regime appeared to lengthen slightly the relapse interval.

METHODS OF TREATMENT

Almost all conceivable methods of treatment or combinations of various treatment schedules have been tried in an effort to "cure" relapsing vivax malaria. Early in these studies, it became quickly apparent

that a specific "cure" is not yet known, with the possible exception which will be described later.

In controlled series of 30 patients each, no difference in therapeutic effect between quinine or dihydroquinine was found; and further, any increase in dosage over 0.50 gram every 6 hours for 7 days failed to influence materially the parasite clearance time, the clinical symptoms, or the interval from time of cessation of drug administration to the next relapse. Any increase in dose over 2 grams daily merely serves to increase all the symptoms of cinchonism and the studies indicate that the usually recommended dosage of 3 grams daily is a waste of quinine in the vast majority of cases. An exceptional case that either may not absorb normally, or degrades the administered quinine more rapidly may need 3 grams daily.

Quinacrine dihydrochloride (atabrine) has proved itself to be (a) superior to quinine as an antimalarial drug. This is especially obvious when it is used in suppressive doses and for the apparent "cure" of *Plasmodium falciparum* malaria when suppressive quinacrine is continued for 23 or more days following the experimental inoculation of this type of malaria to human volunteers. (b) Its effectiveness in the field with respect to *P. falciparum* malaria is also shown by the fact that *P. falciparum* malaria is very rarely seen in the returned serviceman.

The authors' observations lead to the belief that there is no significant advantage to be gained by any prolonged administration of this drug beyond the recommended 7-day period for the treatment of the acute attack. The officially recommended dosage schedule of 0.2 gram every 6 hours for 5 doses followed by 0.1 gram 3 times a day for 6 days making a total of 2.8 grams in 7 days, has been found to be effective, judging by the therapeutic response or relapse interval as compared with a total dosage of 4.5 grams given in 10 days. While no personal experience was had with therapeutic regimes involving long continued quinacrine administration, quinine quinacrine regimes, sulfa drug and quinacrine combinations, or arsenic and bismuth in various combinations with quinacrine, the authors have records of over 100 patients who had undergone various regimes of therapy falling within these categories of treatment, and who had relapsed just as promptly following the completion of this "special" treatment schedule as they had following routine quinacrine treatment of the acute attack.

A modification of the routine quinacrine treatment, which may be useful in certain cases where the prompt return to duty of personnel suffering from acute malaria is imperative, is the so-called "flash" treatment. In this regime, the patient simultaneously receives 0.4 gram of quinacrine intramuscularly and 0.2 gram orally, followed by

0.2-gram oral doses every 4 hours for 3 doses, or a total of 1.2 grams in 12 hours. This is followed by a daily regime of 0.1 gram orally as long as the patient remains in an endemic area, or for 10 to 16 days if on duty in a nonendemic area. Using this type of treatment in a series of 31 patients, it was found that no patient experienced a second chill and that within 48 hours all patients were ambulatory and could, if necessary, carry on their usual duties. The plasma concentration of quinacrine in these 31 patients at 14 hours was found to range from 35 to 108 micrograms per liter. This leveled off after the fourth day, dropping to a suppressive level at 8 days, but remained within the range of therapeutic levels for 5 days. Using this regime, there were no toxic symptoms of significance and it compared favorably with the standard 7-day treatment as far as the relapse interval was concerned.

It is believed that this "flash" treatment or a modification of it as called for by the condition of the patient would be ideal routine therapy for the varied syndromes of "cerebral malaria" as found in the field. Studies at this activity and elsewhere show that following the intramuscular injection of quinacrine, a therapeutic level is reached in the plasma within 15 to 30 minutes, and is maintained for a considerable time when compared with quinine, and has none of the dangers of the conventional routine intravenous quinine treatment of "cerebral malaria." The experience of the authors in using intramuscular quinine has been such that its use has been given up entirely and reliance placed on intramuscular quinacrine to accomplish the desired therapeutic effect in the acute attack of malaria. The usual indications for the use of intramuscular quinacrine are persistent intractable vomiting with dehydration, a sudden operative procedure in the presence of the acute relapse, serious co-existing diseases such as meningitis or pneumonia where it is desirable to secure a prompt antimalarial effect, or in the very rare individual where study has shown that oral administration does not result in a therapeutic plasma level.

Controlled studies showed that following the routine 7-day treatment of the acute attack with quinacrine, two-thirds of the cases relapsed within 120 days, the large majority of them between 30 and 60 days. The earliest relapse following this regime was 21 days from the end of the treatment. Similar studies using routine quinine therapy revealed that two-thirds relapsed within 60 days, with a relapse recorded within 5 days of the completion of a standard 7-day course of treatment. With respect to the responses of clinical symptoms, the relapse interval, or the number and degree of toxic symptoms, all the studies showed that quinacrine is far superior to quinine in all respects. Furthermore, the height of the plasma level achieved with quinacrine as well as other antimalarial drugs tried bore no relation to the length of interval before the next relapse, providing a therapeutic level was

reached. Levels as high as 50 times the therapeutic level show no advantage in this respect.

Long continued quinacrine suppression for as long as 2 years following return to this country had been advocated by some authorities as a possible "cure" of *P. vivax* malaria. Studies on a large scale to determine the effectiveness of this procedure are now underway in various military installations. However, while sufficient data on this point must await further time to elapse, the authors have the impression that malaria appears to "age" very little while under suppression. A few cases that have continued suppression for from 12 to 18 months after arrival in this country have promptly relapsed with *P. vivax* malaria upon discontinuing their quinacrine. In a small group kept free of malaria for 8 months by administration of a therapeutic dose of one of the newer antimalarials once monthly, patients have been regularly relapsing within 4 to 8 weeks after being taken off suppression.

Plasmochin-quinine treatment.—The use of plasmochin⁵ in the treatment of malaria is not new. The literature contains many conflicting statements regarding its benefit in relapsing vivax malaria. Recently, however, under the auspices of the National Research Council, a critical evaluation of some former work has been done and certain recommendations made to the military for a controlled study of the effect of plasmochin on relapsing vivax malaria as seen in the serviceman returned from the Pacific area. Seventeen cases of proved, frequently relapsing vivax malaria were treated for 14 days as follows:

- | | |
|-------------------|--|
| 1 and 2 days ---- | Quinine sulfate 1 gram and plasmochin naphthoate 0.020 gram at 0800, 1600, and 2400. |
| 3 to 7 days----- | Quinine sulfate 0.6 gram and plasmochin naphthoate 0.020 gram at 0800, 1600, and 2400. |
| 8 to 14 days----- | Quinine sulfate 0.6 gram and plasmochin naphthoate 0.040 gram at 0800, 1600, and 2400. |

Under this regime of therapy, mild to severe symptoms of cinchism and gastro-intestinal irritation were present in all patients, but all were able to carry on without too much discomfort and none asked to be released from the experiment. Audiograms done before and after the end of treatment showed no significant changes in auditory acuity. Frequent electrocardiograms revealed only transient abnormalities in rate and rhythm in only four cases. No alarming changes were noted in the peripheral blood on daily check of red and white cells, and urinary abnormalities were absent. No significant methemoglobinemia was demonstrated in this series of patients.

Following an observation period of 120 days from end of treatment, in this group of 17 patients there has been but 1 relapse which took

⁵ The plasmochin naphthoate was supplied by the National Research Council in 20 mg. tablets, and each tablet was equivalent to 10 mg. of plasmochin hydrochloride.

place on the seventieth day following end of treatment. These results are much the best of any previous regime of therapy in the authors' experience. While the number of patients is small, similar results have been reported by others using a much larger series of patients and after reviewing their results and those of this regime of therapy, the opinion is expressed that this type of treatment is the answer to the problem of relapsing vivax malaria, pending the discovery of a more potent "curative drug." This conclusion is based on the patients' reactions following the completion of treatment in addition to the observations of the relapse interval. For the first time in this experience, patients volunteered the information that they "felt" they had been "cured." Vague symptoms and subjective sensations which they were unable to elucidate objectively upon other than to say "I feel," which had previously persisted following an acute attack, were now absent. Curiously enough the 1 patient who did relapse, did not share the enthusiasm of the others and claimed that he felt sure that he was going to relapse after the completion of treatment. While this observation may be merely coincidental, if this characteristic can be demonstrated in much larger series of patients, and any correlation proved to exist between any change in mood of the patient and the relapse following therapy, it might be possible to foretell accurately the future course of the malaria and obviate the necessity of prolonged observation.

It is to be emphasized that this plasmochin-quinine treatment is not without serious danger (19) and should not be attempted unless the patient is hospitalized and daily medical supervision is possible, so that prompt treatment may be administered to anyone showing one of the more serious toxic reactions such as a massive hemolytic anemia. It is believed that under these conditions, this treatment is safe, and untoward reactions can be treated without serious sequelae. It is believed that an ordinary gross and microscopical examination of the urine voided just prior to administration of a dose of plasmochin will do much to anticipate a possible serious reaction. If any hemoglobin, excess red cells, or bile is present, the drug administration should be stopped immediately. Cyanosis of nail beds is an early sign of toxicity.

Other antimalarials.—Under the auspices of the National Research Council, there have been developed numerous new antimalarial compounds. Some of these have undergone extensive clinical testing at this and other centers and have shown much greater antimalarial activity than either quinine or quinacrine. Details cannot be given, but it can be said that it is very likely that in the future, both quinine and quinacrine will be replaced by more potent drugs, capable of

causing a remission of the acute attack by treatment of only 1-day duration.

ALLEGED SEQUELAE OF RELAPSING VIVAX MALARIA

The specific drug treatment of the acute attack of malaria in the returned serviceman is a relatively minor part of the whole treatment in a certain percentage of patients. The authors feel that in a large degree this will also hold true when this same serviceman is treated as a civilian. The problems of post-war adjustment to a civilian status are similar to the problems of adjustment to a military life from a civilian status that existed earlier. Insecurity, fear of the future, rebellion at authority, family "troubles," all exist in civilian life as in military life. The reactive soil of the individual personality is fundamentally the same, and while the outward manifestation of the behavior may appear different when in different statuses, the mechanism behind the reaction is the same, namely, the type of personality make-up of the individual. Unfortunately, for the future evaluation of symptoms that will undoubtedly be the basis for claims of compensation for service-connected illnesses such as malaria, there have appeared in the literature numerous papers on alleged sequelae of relapsing vivax malaria, based on short-term observation or inadequate study of the individual.

In the presence of a regularly recurring disease like malaria, where relapses have been shown to occur from 5 days onward following a complete course of antimalarial drug treatment, it is altogether too easy to attribute any persistent *or* coincidentally occurring symptom to the malaria. The very unpredictability of the relapse makes it possible, if one does not observe a large series of patients over an extended period of time, to attribute practically any abnormal manifestation to the malaria. However, there is a high degree of probability that by mere chance alone, a malaria relapse and a nonrelated symptom would be found together.

Very early in this study it was apparent that all malaria patients fell into two large groups. The first, comprising about 80 percent of patients, consisted of those who responded promptly to treatment, were ambulatory on the second or third day, and expressed a wish to be returned to duty promptly. They complained of nothing in particular, although when questioned closely, they admitted a little fatigue or dull aches or slight loss of appetite, etc., but this group belittled any residual from the acute relapse of a few days previously, and went to duty gladly if they were not in a special study group. The remaining 20 percent of the patients, however, all offered persistent residual complaints following treatment and were strongly averse to going back to duty. Prominent among these complaints were headache,

weakness, morning nausea with occasional vomiting, anorexia, "black-outs," and other vague complaints of insomnia, "poor memory," nervousness, etc.

Carefully supervised rehabilitation programs with encouragement and placement, if possible, in suitable types of duty, in most cases caused the disappearance of the majority of these nonspecific symptoms. Only the complaint of headache remained to be studied.

CHRONIC HEADACHE

This was the most frequent residual symptom following treatment of an acute relapse. It persisted in the relapse interval, when all laboratory and clinical evidence was against any demonstrable activity of the malaria, in 14.9 percent of all patients. In 10 percent of patients it was severe and persistent enough to preclude their early return to duty. The headache was usually frontal in character and persisted all day from arising in the morning until retiring at night. In most cases, the intensity was unchanged, but in some it became worse and in others it improved as the day progressed. Very frequently it was accompanied by a marked intolerance to exercise, especially in the sun. Many cases had an accompanying asthenia and anorexia, but the main and persisting complaint was headache. This type of case soon began to become a veritable "headache" to the medical officers charged with the treatment and disposition of these patients.

Early in the study of these cases, every conceivable aid to diagnosis that could be invoked without danger to the patient was performed in order to attempt rational treatment. Careful physical and neurological examinations were done; spinal fluid dynamics were carefully studied. X-rays of the skull and paranasal sinuses were done on all cases during the early part of the study. Numerous and varied blood chemistry, metabolism, and allergy tests were performed. Electroencephalograms were taken in all cases; in some cases repeated electroencephalograms were taken at the peak intensity of the headache if such existed, during the height of fever of a clinical relapse, before and after therapeutic courses of various antimalarial drugs, and at other times. The final evaluation of this electroencephalographic study will be given later. Suffice it to say here that all the diagnostic studies were of no avail in trying to demonstrate any specific type of pathology to account for the persisting interval headache. Having no success with trying to find a cause, the next step was an empirical trial of various agents in an effort to relieve this symptom. The usual sedatives and analgesics had little if any effect. In rotation, injections of adrenalin, dextrose, ergotamine tartrate, thiamine hydrochloride, calcium gluconate, histamine, and liver extract were tried. Amyl nitrite inhalation, inhalation of pure oxygen by mask, nitroglycerin

under the tongue, histaminase, multiple vitamins, nicotinic acid, ferrous sulfate, and large doses of antimalarial drugs were also tried. Contrary to the experience of others (20), except for the temporary alleviation that might be experienced by any group when trying various new remedies, none of these agents was of any use in causing a significant reduction of the headache symptom. At this point, re-examination of the problem was done and the cooperation of the neuropsychiatrist was invited to attempt a solution.

There were various reasons for suspecting this to be mainly a psychosomatic symptom, without any evident organic basis. First was the inability to demonstrate any significant abnormality by careful clinical tests. Second, while practically 100 percent of these patients suffered headache during the acute phase of their malaria only 15 percent continued to complain after the treatment of the acute attack. Here was noted perhaps the most significant fact of all, that during the height of the paroxysm, when good reasons existed for a headache, these same patients who suffered from chronic headaches, were relieved of their headache by the oral administration of codeine and aspirin. With the remission of the acute phase, however, the readministration of codeine and aspirin had very little effect upon their headache. This difference of response became more apparent, as data were collected from more cases of chronic headaches that were observed through one or two paroxysms without any treatment except the use of sedatives.

Having decided that malaria *per se* had very little to do with the chronic headache, various other possibilities were explored. Careful psychiatric study was done in all cases and the pertinent personality factors will be listed in more detail later. If one were to judge only by the tons of aspirin that are consumed daily, by the number of places that are equipped with "headache-cure" dispensers, by the radio programs sponsored by headache-powder manufacturers, or even by recollections about one's friends, it should be obvious to anyone that chronic headache is common in the civilian population group. Accordingly, in order to check the impression of the lack of any causal relation of chronic headache to malaria, a study was made of the incidence of chronic headache for which no cause or cure could be found among the various medical and surgical patients, including WAVES, in the hospital. It was found that from 10 to 20 percent of them complained of the symptom. An excellent opportunity to check this symptom further was afforded by reason of distribution of medical cases upon first admission to this hospital. A large ward was set aside for the admission of all cases entering with a diagnosis of undetermined disease, gastro-intestinal disease, or headache of undetermined origin. With respect to age, sex, and occupational status,

admissions to this general medical ward were strictly comparable to the malaria study group. During the period of the malaria study (March 1944 to November 1945) 1,359 admissions to this general medical ward were reviewed. Among these, 163 patients were admitted who presented as an only dominant symptom, chronic headache that was in all respects equal to that in the malaria group as far as etiology, persistence, and response to therapy of many kinds. The only difference was that these cases *had no history of malaria* and repeated smears for malaria had been negative. The records were not complete enough to evaluate their degree of exposure, if any, in a hyperendemic malaria area, but the majority of these cases had had no duty overseas, although they were liable at any time for such duty.

Thus, of a comparable group of young adults, 163 out of 1,359 general admissions, or about 12 percent, showed as the main disability chronic headache, which, as far as could be determined, was in no way related to malaria, trauma, migraine, etc. It is not felt that there is any significant difference of the incidence of chronic headache between the malaria group of 14.9 percent and this 12 percent in a malaria-free group. Certainly if the premise is correct that chronic headache of the type under discussion is principally psychosomatic, then the malaria group, which consisted of over 90 percent Marines who had been through several campaigns, had sufficient increase in "psychic trauma" to account for the extra 3 percent incidence of headaches when compared to a relatively "normal" group. Another pertinent observation that adds a little more evidence to this premise was that in many instances, the increased admissions in the malaria group because of chronic headache, asthenia, and vague gastrointestinal symptoms, occurred whenever the Marine Corps conducted physical examinations with a view toward furnishing replacements for the overseas battalions. It is to be recalled that as of June 1944, 15,000,000 men had been examined by armed forces induction stations and a total of 4,217,000 had been rejected, of which 701,700 or 16.6 percent were rejected for mental diseases; and that 44.6 percent of all disability discharges from the armed services were due to neuropsychiatric illness (21). Therefore, it is not surprising that real psychosomatic symptoms should exist in 15 percent of the malaria subjects, who have better reasons for developing such symptoms. The surprising thing is that so few of these cases presented such symptoms and that so many could be returned to duty.

*Electroencephalogram study.*⁶—The prominence of the complaint of headache, and other less striking and less persistent symptoms referable to the central nervous system in chronic recurrent malaria

⁶ This section was prepared by R. Cohn.

pointed to a possible disturbance of cortical neuronal physiology. Disturbances of brain cell physiology manifest themselves in the human electroencephalogram primarily by the production of relatively low frequency (below 8 waves per second) potential differences. This phenomenon is most clearly observed when the intraneuronal function is impaired by a break in its metabolic (oxidative) mechanisms, such as that induced by lowered available glucose to the brain and by oxygen poisoning.

Two groups of patients form the basis of this presentation. The first, comprising 105 individuals, showed recent objective signs of chronic recurrent malaria. Certain of these patients had tracings made during intervals of acute paroxysms of malaria; the majority had electroencephalogram recordings only during intervals of remission of symptoms, other than headache.

The second group (control) consisted of 604 patients without malaria who presented the prime complaint of headache. Careful and comprehensive studies did not show any changes in the somatic or intracranial structures to account for the intensity and tenacity of the headaches in this second group.

All recordings were made under standard conditions with a Grass 6-channel electroencephalograph. All monopolar recordings were taken with reference to the ungrounded ear leads.

RESULTS

Figure 1 is a graphic representation of the results obtained in the two groups of patients under consideration. It will be observed that of those subjects who complained of headaches and

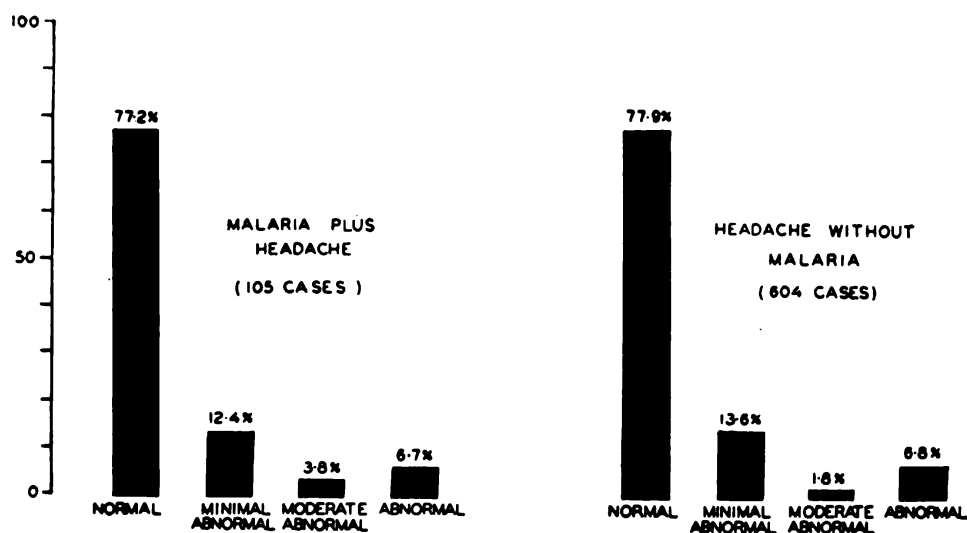


FIGURE 1.

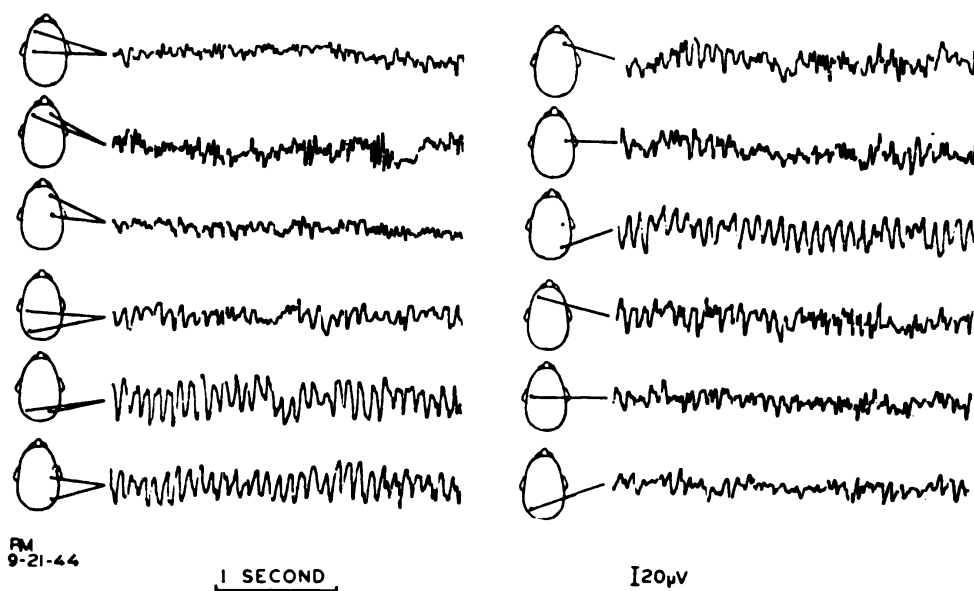


FIGURE 2.

were coincidentally subject to recurrent attacks of malaria, 77.2 percent had recordings that were within the range of normal variation. These records showed no disturbance in the voltage or frequency characteristics; and no unusual wave forms were recognized (fig. 2). In this series of patients 12.4 percent had recordings that showed *minimal abnormalities* (fig. 3). The

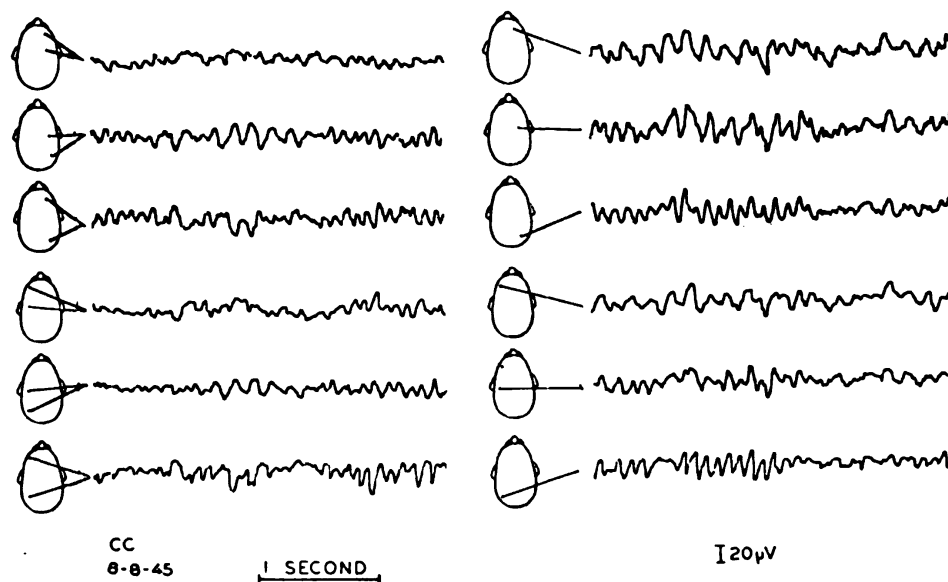


FIGURE 3.

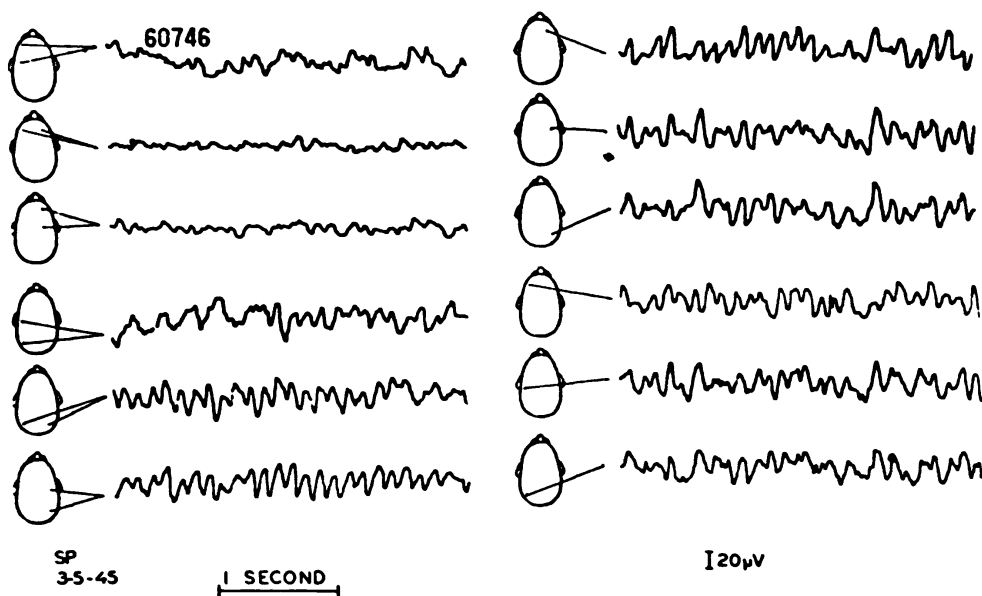


FIGURE 4.

usual electroencephalogram findings in these cases consisted of occasional isolated slow waves (around 160 milliseconds in duration) and some break in the frequency and voltage regulations. Of the malaria plus headache patients 3.8 percent gave tracings designated as *moderately abnormal*. These records showed some accentuation of the voltage and frequency changes defined under

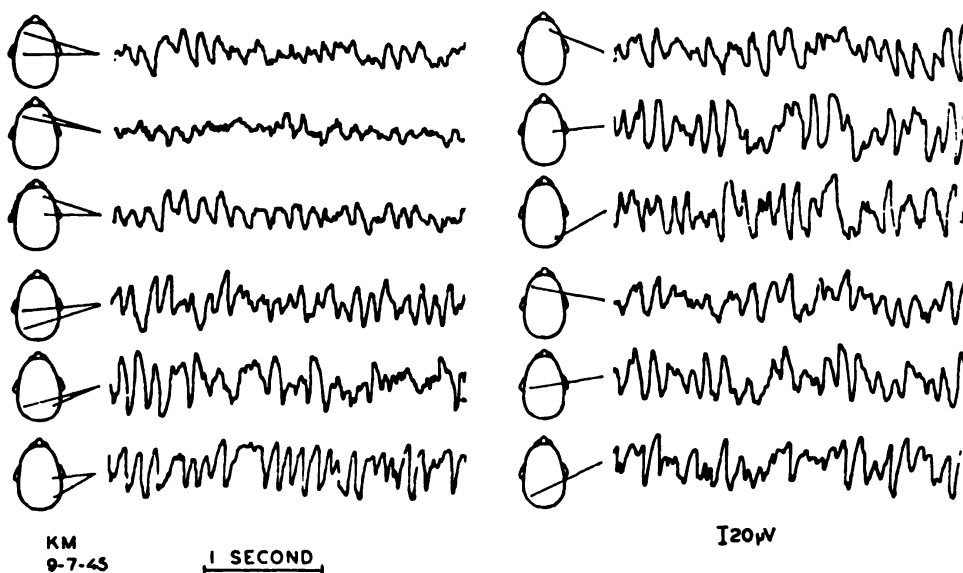


FIGURE 5.

"minimal abnormalities" (fig. 4). Frankly *abnormal* tracings were observed in 6.7 percent of the electroencephalograms. Relatively long sequences of approximately 6 per second, or slower waves, were usually cofeatured with poor voltage and frequency regulations (fig. 5).

As observed from figure 1 the individuals who presented headache as their *dominant complaint* showed percentages of normal, minimal abnormal, moderate abnormal and abnormal electroencephalograms that were almost identical to those who suffered from *headaches with malaria*.

DISCUSSION

The percentage of records outside the range of normal variation is somewhat greater than one would expect from a random sample of population in the age range studied in this series. An important factor in the relatively large number of abnormal tracings in the malaria group may be the inclusion of acute cases who had fever at the time records were made. Another, and probably more important, factor for the larger than expected number of abnormal electroencephalograms is that malarial infections are not limited to individuals with well functioning brains. Malaria may occur in individuals who have physiologically disturbed brain function. This disturbed function may manifest itself in any neurologic or psychiatric form. In the instance under consideration the manifestations were head discomfort and more generally personality disorders. This postulation does not assume that all personality disorders are the result of basic neuronal dysfunction, but that a certain number of clinical personality disorders are promulgated on the basis of disturbed neuron activity. Hence, irrespective of the presence or absence of a coincidental infectious disease, clinical neurologic and psychiatric difficulties may be expected in these subjects.

The coincident, almost congruent, high percentage of abnormal records in the individuals with headaches but without malaria tends to confirm the foregoing hypothesis that a moderate number of individuals who present clinical psychiatric pictures of personality disorders in general, and headaches in particular, are suffering from basic brain cell dysfunction.

The qualitative and quantitative electroencephalogram findings in headaches with *chronic recurrent malaria* and in headaches *unaccompanied by any recognized disease process* involving structural changes are almost identical. This strongly indicates that the headaches of malaria are coincidental to, and not an integral part of, the malarial infection.

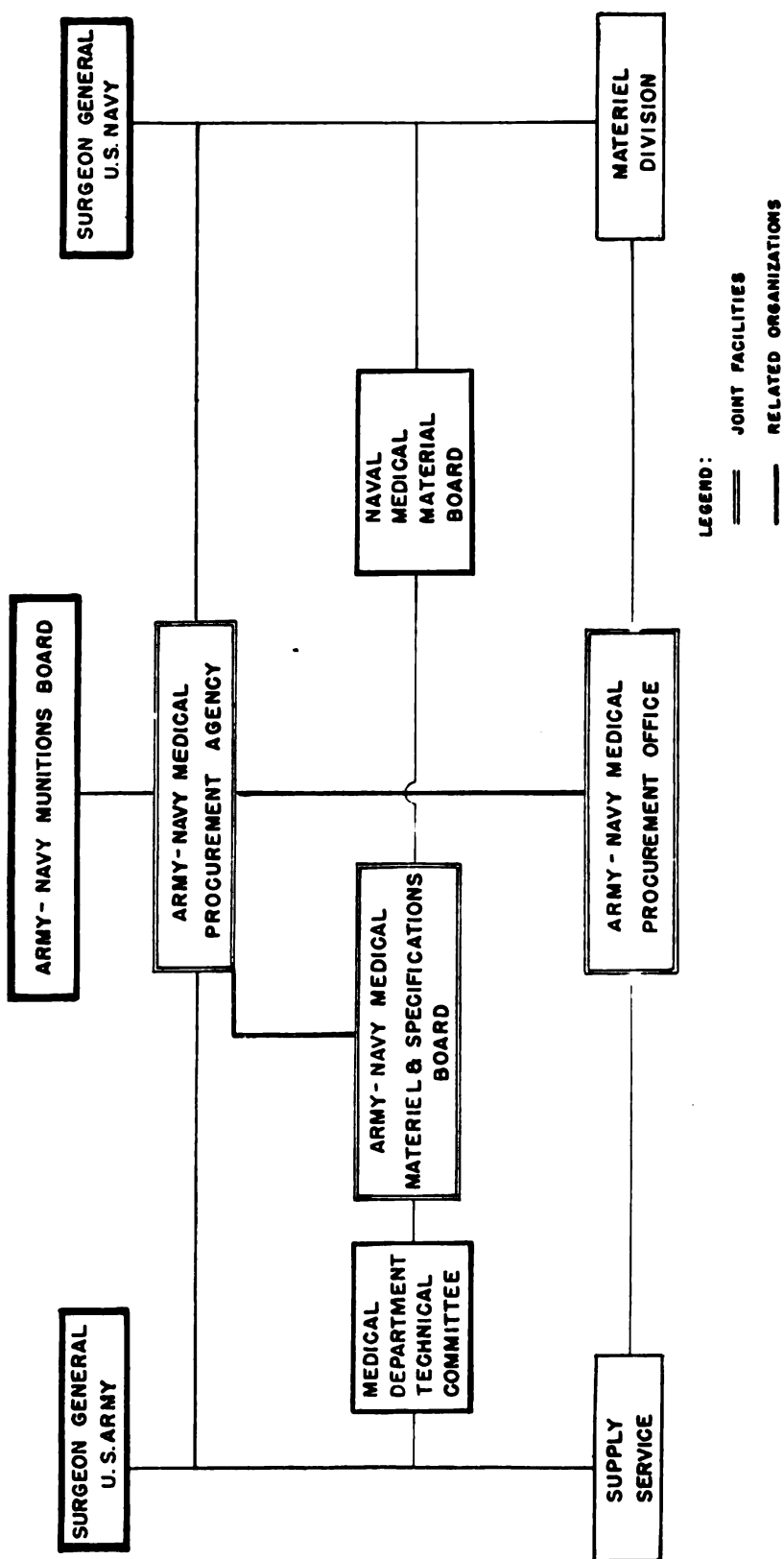
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ORGANIZATION CHART



NOTES ON CONTRIBUTORS



Barnes, LaVerne A., Commander H(S) USNR (*Observations on the Production of Hydrogen Sulfide by Shigella Alkalescens*, p. 478). B. S., 1925, M. S., 1928, and Ph. D., 1929, State College of Washington, Demonstrator in Bacteriology, Western Reserve School of Medicine, 1925-26; teaching fellow in bacteriology, State College of Washington, 1926-29; senior instructor in bacteriology, Western Reserve School of Medicine, 1929-31; senior bacteriologist, Massachusetts Department of Public Health, 1931-; assistant in preventive medicine, Harvard Medical School and School of Public Health, 1931-42. Appointed lieutenant, H-V(S) USNR, 21 Feb. 1942. Served at U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md., and U. S. Naval Medical Research Institute, Bethesda, Md. Fellow: American Public Health Association; member: Society of American Bacteriologists, American Association of Immunologists, and Massachusetts Public Health Association. Coauthor, *Biology of Pneumococcus*, Commonwealth Fund, 1938.

Barnett, Garold S., Chief Pharmacist's Mate, USN (*Malaria Control*, p. 529). Enlisted 12 Dec. 1929 as hospital apprentice, second class; appointed chief pharmacist (T) 15 Sept. 1944; now serving as a chief pharmacist's mate. Specialty: Laboratory technician, U. S. Navy. Preservice education consisted of completion of grammar school, high school, and one-half year of college. Served at U. S. Naval Hospital, San Diego, Calif.; U. S. Naval Mobile Hospital No. 4; U. S. Naval Base Hospital No. 10; U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.; U. S. Naval Receiving Station, San Diego, Calif.; and on U. S. S. *Octans*.

Bianco, Anthony A., Commander (MC) USNR (*Long-Term Observation of Plasmodium Vivax Malaria in the Returned Serviceman*, p. 550). B. S., Washington Square College, 1930; M. D., University and Bellevue Hospital Medical College, 1933. Intern, July 1933-July 1935, and resident in medicine, July 1935-July 1936, Bellevue Hospital, New York, N. Y.; instructor in clinical medicine, New York University Medical College, Sept. 1939-; assistant visiting physician, Bellevue Hospital, July 1936-, New York University Medical College Clinic, July 1936-, and Welfare Hospital for Chronic Diseases (Welfare Island), July 1939-, New York, N. Y. Appointed passed assistant surgeon, USNR, 15 Aug. 1941 from New York. Specialty: Internal medicine. Medical officer, U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., Jan. 1944-Jan. 1946 (chief, tropical disease service, Oct. 1944-Jan. 1946). Released from active duty 23 Jan. 1946. Member: American Society of Tropical Medicine. Diplomate: American Board of Internal Medicine.

Boshes, Louis D., Lieutenant Commander (MC) USNR (Inactive) (*Psychiatric Evaluation of the Naval Delinquent*, p. 458). B. S., Northwestern University, 1931; M. D., Northwestern University Medical School, 1935. Faculty, Northwestern University, College of Liberal Arts, 1929-31; intern, Michael Reese Hospital, Chicago, Ill., 1935-36, and Cook County Hospital, Chicago,

1936-38; faculty, department of nervous and mental diseases, Northwestern University Medical School, 1940-; fellow in psychiatry, Illinois Neuropsychiatric Institute, Chicago, 1941-42. Appointed surgeon, USNR, 16 Nov. 1942, from Illinois. Specialty: Neuropsychiatry. Served at U. S. Naval Training Center, Great Lakes, Ill., Special Augmented Hospital No. 4, U. S. Naval Hospital, San Diego, Calif., U. S. Naval Training and Distribution Center, Receiving Ship, San Francisco, Calif. Released from active duty 1 Aug. 1946. Now fellow in psychiatry, Illinois Neuropsychiatric Institute, Chicago, associate staff, Michael Reese Hospital, Chicago, and attending staff, Fairview Sanitarium, Chicago. Member: American Psychiatric Association, Illinois Psychiatric Society, Chicago Neurological Society, Illinois Society for Mental Hygiene, American Medical Association, Illinois State Medical Society, and Chicago Medical Society.

Brown, Herbert R., Jr., Lieutenant Commander (MC) USNR (Inactive) (*The Distribution and Use of Human Whole Blood in the Pacific War*, p. 396). A. B., Harvard College, 1934; M. D., University of Rochester School of Medicine and Dentistry, 1939. Intern, assistant resident, and resident in medicine, Strong Memorial Hospital, Rochester, Minn., 1939-42. Appointed assistant surgeon, USNR, 11 July 1942. Specialty: Internal medicine. Served at U. S. Naval Hospital, Brooklyn, N. Y., U. S. Naval Hospital, Philadelphia, Pa., on U. S. S. *Refuge*, and at U. S. Naval Whole Blood Center, Guam. Released from active duty 19 Feb. 1946. Now research fellow in medicine, University of Rochester School of Medicine and Dentistry. Member: Monroe County Medical Society.

Cahill, William F., Lieutenant (DC) USN (Inactive) (*Salivary Calculus in the Submaxillary Duct and Its Removal*, p. 519). D. D. S., School of Dentistry, Georgetown University, 1944. Entered service as ensign, H-V(P), USNR, 11 Apr. 1942; changed to apprentice seaman, V-12, USNR, 12 May 1943; appointed assistant dental surgeon, USNR, 17 Sept. 1944; appointed assistant dental surgeon, USN, 5 Mar. 1945. Served on U. S. S. *Savo Island* and at U. S. Naval Gun Factory, Washington, D. C. Released from active duty 26 Feb. 1947.

Camp, Turner, Lieutenant, junior grade (MC) USNR (inactive) (*Single Injection Therapy for Gonorrhea*, p. 451). B. S., University of Chicago, 1941; M. D., Chicago Medical School, 1944. Intern, Illinois Central Hospital, Chicago, Ill. Appointed assistant surgeon, USNR 30 June 1945. Served at U. S. Naval Dispensary, Puget Sound Navy Yard, Bremerton, Wash. Released from active duty, 13 Aug. 1946.

Campbell, Vernon W. H., Commander (MC) USN (*Army-Navy Medical Matériel Coordination*, p. 481). B. S., Juniata College, 1930; M. D., Jefferson Medical College of Philadelphia, 1939. Civil service chemist for inspector of naval material, 1930-35; intern, U. S. Naval Hospital, Philadelphia, Pa., 1939-1940. Appointed acting assistant surgeon, USN, July 1939 from Pennsylvania. Served on U. S. S. *Henderson*, at U. S. Naval Hospital, Philadelphia, Pa., with Matériel Division, Bureau of Medicine and Surgery, Brooklyn, N. Y., and as deputy chief, Matériel Standards Division, Army-Navy Medical Procurement Office. Member: American Medical Association and Medical Association of the Isthmian Canal Zone.

Carpenter, Cedric C., Commander (MC) USNR (Inactive) (*Nummular Eczema and Prostatitis: Its Treatment With Penicillin*, p. 453). M. D., George Washington University School of Medicine, 1928. Intern, Garfield Memorial Hospital, Washington, D. C., 1928-29; resident, Scripps Metabolic Clinic,

La Jolla, Calif., 1930; house physician, 1931-32, and staff, 1932-37 New York Skin and Cancer Hospital, New York, N. Y.; private practice, Summit Medical Group, Summit, N. J., 1932-43; attending dermatologist, Overlook Hospital, Summit, N. J., and Morristown Memorial Hospital, Morristown, N. J. Appointed surgeon, USNR, 13 Oct. 1943 from New York. Specialty: Dermatology and syphilology. Served at U. S. Naval Hospital, Brooklyn, N. Y., and on U. S. S. *Samaritan*. Released from active duty 8 Apr. 1946. Fellow: American Academy of Dermatology and American Medical Association; member: Investigative Dermatologic Society, North New Jersey Dermatological Society (vice president), Union County Medical Society, and State Medical Society of New Jersey. Diplomate: American Board of Dermatology and Syphilology.

Casterline, Joan E., Pharmacists Mate, first class USNR (*Observations on the Production of Hydrogen Sulfide by Shigella Alkaliscens*, p. 478). Enlisted 31 May 1944 as apprentice seaman and advanced in rating to pharmacist's mate, first class. Preservice education consisted of completion of grammar school, high school, and 2 years of college. Served at U. S. Naval Hospital; U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.; and U. S. Naval Medical Research Institute, Bethesda, Md.

Caveny, Elmer L., Captain (MC) USN (*Emotion, the Etiologic Relation to Illness*, p. 421). M. D., Emory University School of Medicine, 1930. Appointed assistant surgeon, USN, 3 June 1930. Specialty: Psychiatry and neurology; aviation medicine. Intern, U. S. Naval Hospital, Norfolk, Va., 23 June 1930-24 June 1931. Served on U. S. S. *Augusta*; U. S. Naval Air Station, Pearl Harbor, T. H., and U. S. Naval Air Station, Pensacola, Fla. Member: American Medical Association. Diplomate: American Board of Psychiatry and Neurology.

Cohn, Robert, Lieutenant Commander (MC) USNR (Inactive) (*Long-Term Observation of Plasmodium Vivax Malaria in the Returned Serviceman*, p. 550). B. S., George Washington University, 1932; M. D., George Washington University School of Medicine, 1936. Fellow in neurophysiology, 1936-38, and staff member, 1938-43, St. Elizabeths Hospital, Washington, D. C. Appointed passed assistant surgeon, USNR, 18 Dec. 1942. Specialty: Electroencephalography, clinical neurology. Served at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., 1943-. Released from active duty 3 July 1946.

Dyke, Joseph S., Lieutenant, junior grade (MC) USNR (Inactive) (*Nummular Eczema and Prostatitis: Its Treatment with Penicillin*, p. 453). A. B., Columbia University, 1941; M. D., Long Island College of Medicine, 1944. Intern, U. S. Naval Hospital, Brooklyn, N. Y., Oct. 1944-July 1945. Appointed ensign, H-V(P) USNR, 20 June 1942; enlisted as apprentice seaman, V-12 (S) USNR, July 1943; appointed assistant surgeon, USNR, 4 Oct. 1944 from New York. Served with the First Marine Division, 1945-46. Released from active duty, 26 Aug. 1946. Now assistant resident in surgery, Gouverneur Hospital, New York, N. Y.

Gilbert, C. Louis, Commander (MC) USNR (Inactive) (*Tuberculous Pericarditis in a Case of Acute Hematogenous Tuberculosis*, p. 514). B. S., University of Virginia, 1928; M. D., University of Virginia Department of Medicine, 1932. Intern, St. Luke's Hospital, New York, N. Y., 1932-34; resident, Bellevue Hospital, New York, N. Y., 1934-35; assistant attending physician, St. Luke's Hospital and Bellevue Hospital; assistant in clinical medicine, Columbia University College of Physicians and Surgeons. Appointed passed assistant surgeon, USNR, 21 May 1941. Specialty: Internal medicine.

Served at U. S. Naval Base Hospital No. 17 and U. S. Naval Hospital, St. Albans, N. Y. Released from active duty 14 Dec. 1945. Fellow: New York Academy of Medicine; member: American Medical Association and New York County Medical Society.

Goren, Sidney, Lieutenant Commander H(S) USNR (*Report of Investigation of Health Hazards in Connection With the Industrial Handling of Thallium*, p. 545). B. A., Johns Hopkins University, 1936; D. Sc., Johns Hopkins University School of Hygiene and Public Health, 1939. Volunteer assistant, department of physiological chemistry, Johns Hopkins University School of Medicine, Sept. 1939–May 1940; head, department of pathology and pharmacology, Applied Research Laboratories, Inc., Dayton, N. J., May 1940–May 1941. Appointed ensign, H–V(S) USNR, 25 Aug. 1941 from Maryland. Specialty: Industrial hygiene. Served as industrial hygienist, U. S. Naval Gun Factory. Member: American Industrial Hygiene Association and American Association for the Advancement of Science.

Gunther, Walter A., Lieutenant Commander (MC) USNR (Inactive) (*Treatment of Acute Acromioclavicular Dislocations*, p. 444). B. S., Manhattan College, 1931; M. D., Albany Medical College, 1936. Intern, Troy Hospital, Troy, N. Y., July–Nov. 1936; Arnot-Ogden Memorial Hospital, Elmira, N. Y., July 1937–July 1938; assistant in orthopedics, Samaritan Hospital, Troy, N. Y., 1938–43. Appointed assistant surgeon, USNR, 1 Feb. 1943. Specialty: Orthopedics. Served at U. S. Naval Base Hospital No. 9, with Seventh Amphibious Force, and at U. S. Naval Hospital, San Diego, Calif. Released from active duty 19 June 1946. Resident in orthopedic surgery, Knoxville General Hospital, Knoxville, Tenn., July 1946–. Member: American Medical Association and Rensselaer County Medical Society.

Haines, Richard D., Lieutenant (MC) USNR (*Tuberculous Pericarditis in a Case of Acute Hematogenous Tuberculosis*, p. 514). B. S., Mount Union College, 1938; M. D., University of Rochester School of Medicine and Dentistry, 1942. Intern, University Hospitals, Minneapolis, Minn., July 1942–July 1943; fellow in medicine, Mayo Clinic, Rochester, Minn., July 1943–July 1944, and Oct. 1946–. Appointed assistant surgeon, USNR, 31 Aug. 1942. Served at U. S. Naval Base Hospital No. 17. Released from active duty 3 June 1946. Member: American Medical Association; Minnesota State Medical Society; and Olmstead, Fillmore, Dodge Counties Society.

Hutchins, Hal C., Lieutenant, junior grade (DC) USNR (Inactive) (*Accidents Resulting from Loose Dental Objects in the Mouth*, p. 517). B. A., College of Wooster, 1939; D. D. S., College of Dentistry, Ohio State University, 1943. Research fellow (anatomy and physiology of head and neck), University of Buffalo School of Medicine, 1940; staff, department of anatomy, Ohio State University, 1943; intern in oral surgery, periodontia, and oral diagnosis, Metropolitan Hospital, New York, N. Y., 1944. Appointed ensign, H–V(P), USNR, 6 July 1942, and lieutenant, junior grade, (DC) USNR, 13 Apr. 1944. Served at U. S. Marine Corps Air Station, Quantico, Va., and U. S. Naval Air Facility, Columbus, O. Released from active duty 18 Nov. 1945. Resident oral surgeon, Metropolitan Hospital, New York, N. Y., 1946; director, dental department, Delta Clinic, Delta, O.; attending oral surgeon, De Ette Harrison Detwiler Memorial Hospital, Wauseon, O. Member: American Dental Association and Ohio State Dental Association.

Kern, Richard A., Commodore (MC) USNR (Inactive) (*Naval Medical Specialists Units*, p. 429). A. B., University of Pennsylvania, 1910; M. D., University of Pennsylvania School of Medicine, 1914, Instructor, medicine, University of Pennsylvania School of Medicine, 1916–21; associate, University of Pennsylvania School of Medicine and Graduate School of Medicine, 1921–28; assistant professor, 1928–34; professor, clinical medicine, 1934–46; assistant chief of medical service, University Hospital, 1934–46; appointed assistant surgeon, USNRF, 1917; passed assistant surgeon USN, 1918; resigned, 1919; appointed passed assistant surgeon, USNR, 12 Feb. 1925. Specialty: Internal medicine. Served on U. S. S. *Solace*, with U. S. Navy Mobile Hospital No. 7, and at U. S. Naval Hospital, Philadelphia, Pa. Released from active duty 4 Jan. 1946; professor of medicine and head of department of internal medicine, Temple University School of Medicine; chief of medical service, Temple University Hospital, Philadelphia, Pa., 1946; vice president, Board of Health, Lower Merion Township, 1934–; chief, section for general medicine, Central Office, Veterans' Administration, Washington, D. C., 1946–. Fellow: American College of Physicians; member: American Medical Association, Association of American Physicians, American Society for Clinical Investigation, Society for the Study of Asthma (president 1934), American Clinical and Climatological Association, American Association for the Study of Allergy (president 1931), College of Physicians of Philadelphia, Pathological Society of Philadelphia. Diplomate, American Board of Internal Medicine. Assistant editor, 1925–46, and associate editor, 1946–, American Journal of Medical Sciences.

Levine, Arnold S., Lieutenant Commander (MC) USNR (Inactive) (*Long-Term Observation of Plasmodium Vivax Malaria in the Returned Serviceman*, p. 550). B. S., Rutgers University, 1933; M. D., Jefferson Medical College of Philadelphia, 1937. Intern, Jefferson Medical College Hospital, Philadelphia, Pa.; resident, Norristown State Hospital, Norristown, Pa., and Montefiore Hospital for Chronic Diseases, New York, N. Y.; staff, Jefferson Medical College Hospital, Philadelphia General Hospital, and Philadelphia Psychiatric Hospital, all in Philadelphia, Pa.; attending consultant, Mental Hygiene Clinic, Philadelphia. Appointed assistant surgeon, USNR, 16 June 1942 from Pennsylvania. Specialty: Neuropsychiatry. Served at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Released from active duty 15 Feb. 1946. Member: American Medical Association and American Psychiatric Association. Diplomate: American Board of Psychiatry and Neurology.

Miller, Walter R., Commander (MC) USN (*Idiopathic Thrombosis of the Axillary Vein*, p. 508). A. B., University of California, 1933; M. D., University of California Medical School, 1937. Intern, Highland-Alameda County Hospital, Oakland, Calif., July 1936–June 1937, resident, James Whitcomb Riley Hospital for Children, Indianapolis, Ind. Appointed assistant surgeon, USN, 23 Aug. 1937. Served on U. S. S. *Melville*, U. S. S. *California*, U. S. S. *Pennsylvania*, and U. S. S. *Colorado*; at U. S. Naval Dispensary, Long Beach, Calif., U. S. Naval Hospital, Long Beach, Calif., and U. S. Naval Hospital, Seattle, Wash. Member: American Medical Association.

Morgan, Russell E., Lieutenant Commander (MC) USNR (Inactive) (*Malaria Control*, p. 529). B. S., Lebanon Valley College, 1931; M. D., Temple University School of Medicine, 1935; M. S., The Medico-Chirurgical College, Graduate School of Medicine, University of Pennsylvania, 1944. Intern,

Bryn Mawr Hospital, Bryn Mawr, Pa., 1936; private practice, Annville, Pa., 1936-41; chief resident in surgery, St. Luke's Hospital, Bethlehem, Pa., 1942-44. Appointed passed assistant surgeon, USNR, 17 July 1944 from Pennsylvania. Specialty: Surgery. Served at U. S. Naval Base Medical Dispensary, Manus, Admiralty Islands, and on U. S. S. *Chourette*. Released from active duty 31 July 1946. Member: American Medical Association and Medical Society of the State of Pennsylvania.

Nuckolls, Chester R., Commander (MC) USNR (Inactive) (*Nummular Eczema and Prostatitis: Its Treatment with Penicillin*, p. 453). B. A., University of Virginia, 1924; M. D., University of Virginia Department of Medicine, 1928. Intern, City Hospital, Cleveland, O., 1928-30; resident St. Alexis Hospital, Cleveland, 1930-31, and Lakeside Hospital, Cleveland, 1932. Appointed passed assistant surgeon, USNR, 17 Apr. 1942. Specialty: Urology. Served on U. S. S. *Merak* and at U. S. Naval Hospital, Brooklyn, N. Y., and U. S. Naval Hospital, Dublin, Ga. Released from active duty 18 Jan. 1946. Member: American Medical Association, Ohio State Medical Association, Cleveland Academy of Medicine, and Cleveland Urological Society. Diplomate: National Board of Medical Examiners.

Pugh, H. Lamont, Rear Admiral (MC) USN (*Burns*, p. 391). B. S., University of Virginia; M. D., University of Virginia Department of Medicine, 1923. Intern, Martha Jefferson Hospital and Sanitarium, Charlottesville, Va., 1922-23. Appointed assistant surgeon, USN, 15 June 1923. Specialty: General Surgery. Chief, surgical service, U. S. Naval Hospital, Pearl Harbor, 1942, and U. S. Naval Hospital, San Diego, 1942-44; medical officer in command, U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md., 1944-46, and chief of surgical service, U. S. Naval Hospital, National Naval Medical Center, Bethesda, June-Dec. 1946; deputy and assistant to chief of Bureau of Medicine and Surgery, 1946-. Fellow: American College of Surgeons; member: American Board of Surgery, American Medical Association. Diplomate: National Board of Medical Examiners.

Rossen, Ralph, Lieutenant Commander (MC) USNR (Inactive) (*A Critical Analysis Obtained from 873 Electroencephalographic Examinations*, p. 494). M. D., University of Minnesota Medical School, 1933. Intern, University Hospitals, Minneapolis, Minn., 1933-34; fellow in neuropsychiatry, University Hospitals, Minneapolis, 1934-36; clinical director, St. Peter State Hospital, St. Peter, Minn., 1936-38; superintendent, Hastings State Hospital, Hastings, Minn., 1938-. Appointed passed assistant surgeon, USNR, 29 Apr. 1943. Specialty: Psychiatry and Neurology. Served at U. S. Naval Hospital, Portsmouth, Va. Released from active duty 11 Apr. 1946. Member: American Psychiatric Association, Minnesota Society of Neurology and Psychiatry, American Medical Association. Diplomate: American Board of Psychiatry and American Board of Neurology.

Saunders, George M., Lieutenant Commander (MC) USNR (Inactive) (*Long-Term Observation of Plasmodium Vivax Malaria in the Returned Serviceman*, p. 550). A. B., University of Wisconsin, 1923; M. D., Harvard Medical School, 1925. Intern, Harper Hospital, Detroit, Mich., 1 year, and Massachusetts General Hospital, Boston, 2 years; tropical and preventive medicine, working with the Rockefeller Foundation and the Leonard Wood Memorial, Africa, West Indies, and Far East, 1930-40; helped to organize the medical service for the air route across Africa, Pan American Airways, 1941; assisted in organizing and developing the Division of Health and

Sanitation of the Office of the Coordinator of Inter-American Affairs, 1942, and was director of the Division's work in Brazil, regional director after November 1942 for Brazil, Paraguay, Peru, Bolivia, and Chile. Appointed surgeon, USNR, 3 May 1925. Served at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Released from active duty, 25 Feb. 1946. Assistant professor of preventive medicine, Washington University School of Medicine; consultant in tropical diseases, ward medical services, Barnes Hospital, St. Louis, Mo. Diplomate: National Board of Medical Examiners.

Sessions, Howard K., Captain (MC) USN (*Report of Investigation of Health Hazards in Connection with the Industrial Handling of Thallium*, p. 545). B. S., Emory University, 1928; M. D., Emory University School of Medicine, 1931. Certificate in Industrial Hygiene, Harvard School of Public Health, 1941. Intern, U. S. Naval Hospital, Brooklyn, N. Y., 1931-32. Appointed assistant surgeon, USN, 30 June 1931, from Georgia. Served on U. S. S. *Pecos* and U. S. S. *Texas*; station and reservation medical officer, U. S. Naval Station, Olongapo, Philippine Islands, 1939-40; assistant chief health consultant, U. S. Maritime Commission, 1943; head, Industrial Health Section, Bureau of Medicine and Surgery, 1945-46. Member: American Medical Association and American Industrial Hygiene Association.

Sheppard, Raymond R., Ensign, H(S) USNR (Inactive) (*Malaria Control*, p. 529). B. S., University of Florida, 1935. Junior soil conservationist (engineering and pest control), U. S. Soil Conservation Service, Laurel, Miss., Jan. 1939-42; malariologist, U. S. Public Health Service, 1942-43. Appointed Ensign, H(S), USNR, 30 Apr. 1945 from Florida. Specialty: Malaria control and entomology. Served at Camp Pendleton, Calif., Russell Islands, and Manus Island. Released from active duty 24 July 1946.

Snell, William E., Lieutenant, junior grade (MC) USNR (*Treatment of Acute Acromioclavicular Dislocations*, p. 444). B. S., University of Oregon, 1942; M. D., University of Oregon Medical School, 1945. Appointed assistant surgeon, USNR, 22 June 1945. Intern, U. S. Naval Hospital, San Diego, Calif., 1945-46.

Steiner, Morris, Commander (MC) USNR (Inactive) (*Cerebrospinal Fever Complicated by Extensive Thrombotic Gangrene of the Skin and Subcutaneous Tissues, Hematuria and Anuria; Recovery*, p. 523). M. D., New York University School of Medicine, 1928. Intern, 1928-30, and assistant resident in pediatrics, 1930-31, adjunct attending pediatrician, Jewish Hospital, Brooklyn, N. Y.; fellow, Trudeau School of Tuberculosis; chief, Juvenile Tuberculosis Clinic, and staff, Pediatric Research Laboratory, Jewish Hospital, Brooklyn, N. Y. Appointed surgeon, USNR, 20 July 1942 from New York. Specialty: Pediatrics. Served at U. S. Naval Hospital, Naval Operating Base, Norfolk, Va., and on U. S. S. *Crescent City*. Released from active duty 23 Jan. 1946. Fellow: American Medical Association, American Academy of Pediatrics, and Brooklyn Academy of Pediatrics; member: American Trudeau Society, Kings County Medical Society, New York State Medical Society, and American Association for the Advancement of Science. Diplomate: American Board of Pediatrics.

Stubenford, John G., 3d Commander (MC) USN (*An Evaluation of a Physical Training Program at a Naval Air Station*, p. 473). A. B., Columbia College, 1924; M. D., Cornell University Medical College, 1927. Intern, Reconstruction Hospital (Unit of New York Post-Graduate Medical School and Hospital), 1926-27, Memorial Hospital for Cancer and Allied Diseases,

New York, N. Y., 1927, and New York Hospital, New York, N. Y., 1928-30; private practice, Douglaston, N. Y., 1930; assistant attending surgeon, dispensary, Flushing Hospital and Dispensary, Flushing, N. Y., 1930-39; clinical assistant visiting surgeon, Queens General Hospital, Jamaica, N. Y., 1935-36; assistant surgeon, Mary Immaculate Hospital, Jamaica, N. Y., 1941-43. Appointed surgeon, USNR, 23 Feb. 1943 from New York. Specialty: Aviation medicine. Served at U. S. Marine Corps Air Station, Cherry Point, N. C.; U. S. Naval Air Station (Boca Chica), Key West, Fla., and with Carrier Air Photographic Reconnaissance Training School, USNAF, New Cumberland, Pa. Transferred to Regular Navy 1 Apr. 1947. Fellow: American Association of Industrial Physicians and Surgeons; associate fellow: Aero Medical Association; member: American Medical Association, Medical Society of the State of New York, and Queens County Medical Society. Diplomate: National Board of Medical Examiners.

Titus, Paul, Captain (MC) USNR (Inactive) (*Medical Specialists in Naval Service*, p. 438). M. D., Yale University School of Medicine, 1908. Assistant, Universitäts Frauenklinik, Heidelberg, Germany, 1908-10; assistant in obstetrics, Johns Hopkins Hospital, Baltimore, Md., 1910-11; resident obstetrician and gynecologist, Magee Hospital, Pittsburgh, 1911-12; obstetrician and gynecologist, St. Margaret Memorial Hospital, Pittsburgh, Pa. Appointed surgeon, USNR, 16 May 1944 from Pennsylvania. Specialty: Obstetrics and gynecology. Served with the Professional Division and the Personnel Division, Bureau of Medicine and Surgery, Washington, D. C. Released from active duty 25 Feb. 1946. Now obstetrician-gynecologist, St. Margaret Memorial Hospital, Pittsburgh, Pa., and consulting obstetrician-gynecologist, Shadyside Hospital, Pittsburgh. Fellow: American College of Surgeons; American Medical Association; American Association of Obstetricians, Gynecologists and Abdominal Surgeons (executive council 1929-35 and 1939-46; president, 1938); American Gynecological Society; member: Medical Society of the State of Pennsylvania, Pittsburgh Academy of Medicine (President, 1929-30), and Allegheny County Medical Society. Diplomate: American Board of Obstetrics and Gynecology. Secretary, treasurer, and director, American Board of Obstetrics and Gynecology; secretary-treasurer, 1933-41, and president, 1945-47, Advisory Board for Medical Specialties; member, advisory editorial board, American Journal of Obstetrics and Gynecology. Author: *The Management of Obstetric Difficulties*, C. V. Mosby Company, St. Louis, Mo., 1937, 2d edition, 1940, 3d edition, 1945; *Diseases of Women for the General Practitioner*, National Medical Book Co., Inc., New York, N. Y., 1937; *Atlas of Obstetric Technic*, C. V. Mosby Company, St. Louis, Mo., 1941.

Warden, Cyrus E., Lieutenant Commander (MC) USNR (Inactive) (*A Case of Gas Gangrene of Neck Following Extractions*, p. 521). A. B., Columbia College, 1928; M. D., Columbia University College of Physicians and Surgeons, 1932. Intern, French Hospital, New York, N. Y., 1932-35; postgraduate work in surgery, New York University College of Medicine and Bellevue Hospital, 1936-39; instructor in surgery, New York University College of Medicine, 1936-41; assistant surgeon, Welfare Hospital for Chronic Diseases (Welfare Island), New York, N. Y., 1940-42, and New York City Hospital (Welfare Island), New York, N. Y., 1941-42. Appointed passed assistant surgeon, USNR, 16 Aug. 1942 from New York. Specialty: Surgery. Served at U. S. Naval Base Hospital No. 12 and on U. S. S. *Kitson*. Released from active

duty 11 Feb. 1946. Now assistant attending surgeon, French Hospital, New York, N. Y. Fellow: American College of Surgeons; member: American Medical Association and New York County Medical Society.

Woelfel, George F., Lieutenant, junior grade (MC) USNR (*Idiopathic Thrombosis of the Axillary Vein*, p. 508). B. S., Marshall College; M. D., Marquette University School of Medicine, 1944. Intern, St. Joseph's Hospital, Milwaukee, Wis., and St. Michael Hospital, Milwaukee; junior resident in surgery, St. Joseph's Hospital, Milwaukee. Appointed ensign, H-V(P), USNR, 27 Apr. 1942 from West Virginia; apprentice seaman, V-12(S), USNR, July 1943-Sept. 1944; appointed assistant surgeon, USNR, 27 Sept. 1944. Served at U. S. Naval Hospital, Seattle, Wash., and on U. S. S. *Oakland*. Member: State Medical Society of Wisconsin.



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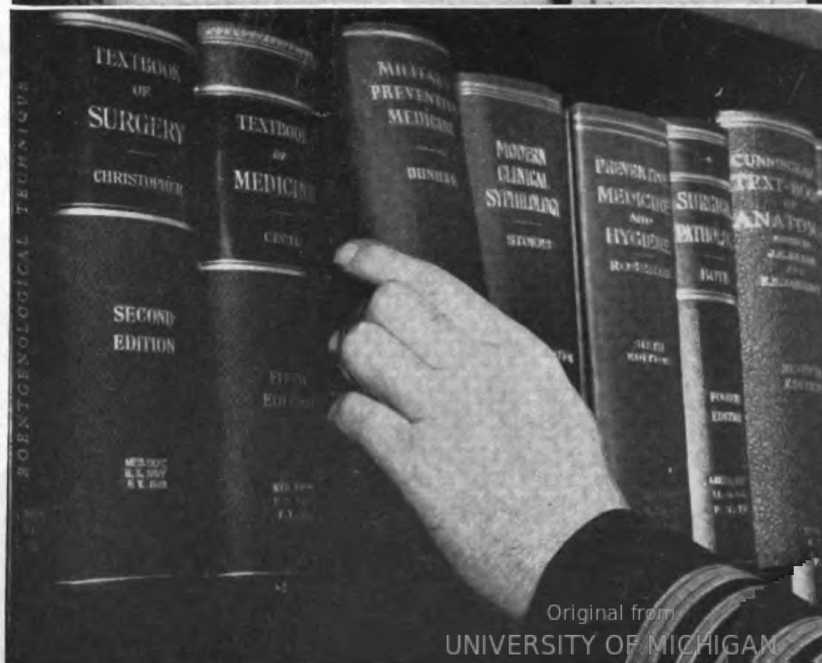
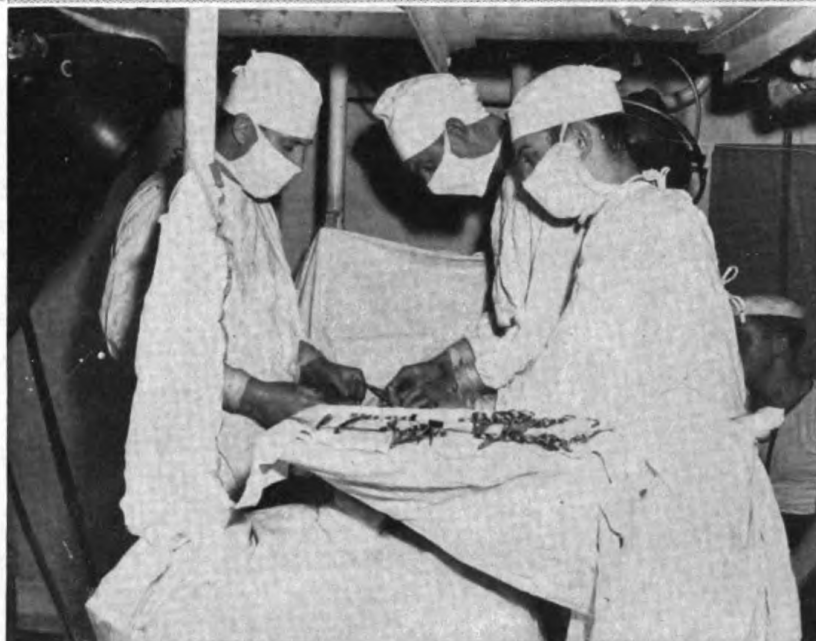


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COVER PHOTOGRAPHS

These two cover pictures represent the theory and the practice of medicine, the relation between medical books and the practical application to clinical work. As is seen by the bulkhead and overhead fittings the operation is being performed on board ship.

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TABLE OF CONTENTS



PREFACE	Page III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Report on Primary Bone Grafts—Herbert C. Fett and Jarvis M. Smith	579
Japanese “B” Encephalitis; Epidemiological Report of the 1945 Outbreak on Okinawa—William E. Mosher, Jr.	586
A Medical Survey of Allied Repatriates After Liberation From Japanese Prisons—John E. Moss	598
The Determination and Treatment of Penicillin-Resistant Gonorrheal Urethritis; Report of Twenty-four Cases—Werner W. Duemling and Samuel H. Horton, Jr.	605
The Relationship Between Measles and Tuberculosis—Marcel P. Thomas and Donald L. Knutson	617
A Consideration of the Significance of Hallucinations—Otto Allen Will, Jr.	622
Appendicitis in a United States Naval Hospital; a Report of 2,404 Consecutive Cases With Emphasis on Fatal Cases—Frederick R. Robbins ..	634
The Local Treatment of Furunculosis With Penicillin—John H. Liles, Jr. ..	645
The Eve Method of Resuscitation—Leo D. Carson and Joseph C. Pinto	650
Urologic and Ophthalmologic Observations in Two Cases of Reiter’s Syndrome—Everett J. Olenick and James W. Sargent	657
The Rh Factor—William Hunt	663
The Bankart Operation for Recurrent Dislocation of the Shoulder—John W. Metcalfe	672
Psychiatric Screening Tests at a Precommissioning Center—Roland C. Moore	676
Osteoplastic Repair of Defects of the Tibia Following Osteomyelitis Due to Trauma—Sidney Sideman and Walter A. Gunther	683



EDITORIALS

	Page
New Discoveries in the Physiology of the Kidney; Neurovascular Studies of the Kidney and Their Implications	690
A Census of Specialists in the Medical Corps of the Navy	691
The Shortest and Most Dangerous Journey in the World	692
The United States Pharmacopoeia XIII	693
The National Formulary VIII	694
The Universal Disease	694
Preparation and Palatability of Food in Relation to Nutrition	695

CLINICAL NOTES

Dentigerous Cyst; a Case Report — <i>Ralph W. Taylor and Raymond F. Huebsch</i>	696
Nonpenetrating Wounds of the Small Intestines — <i>Roy E. Mabrey</i>	698
Chorionepithelioma — <i>Ardenne A. Stott, Lawrence J. Cohen, and Edward C. Kley</i>	702
Hemorrhagic Smallpox; Report of a Case With Recovery; Treatment With Massive Doses of Penicillin — <i>Kenneth D. Weeks and Warren S. McClelland</i>	707
Skin Graft of the Penis — <i>Lawrence L. Bean</i>	715

MEDICAL AND SURGICAL DEVICES

A Simple Method of Converting the Standard Stern-McCarthy Prostatic Electrotome to a Pistol-Grip-Trigger Model — <i>William W. Miller, Jr.</i> ---	717
Adjustable Appliance for Intra-Oral Immobilization of Fractures of the Mandibular Angle — <i>Roger G. Gerry</i>	719

BOOK NOTICES

An Integrated Practice of Medicine , <i>Hyman</i> — Victory Over Pain , <i>Robinson</i> — The Centennial of Surgical Anesthesia , compiled by <i>Fulton and Stanton</i> — Pharmacology and Therapeutics , <i>Cushny</i> ; revised by <i>Grollman and Slaughter</i> — Three Unpublished Drawings of the Anatomy of the Human Ear , <i>Brodel</i> , assisted by <i>Malone, Guild, and Crowe</i> — Peripheral Vascular Diseases , <i>Allen, Barker, and Hines</i> , with associates in the <i>Mayo Clinic and Mayo Foundation</i> — Clinical Electrocardiography , <i>Scherf and Boyd</i> — Principles of Hematology , <i>Haden</i> — Renal Hypertension , <i>Bruan-Menendez, Fasciolo, Leloir, Munoz, and Taquini</i> ; translated by <i>Dexter</i> — Operative Gynecology , <i>Te Linde</i> — Textbook of Gynecology , <i>Curtis</i>	725
---	-----

PREVENTIVE MEDICINE

	Page
Routine Photofluorographic Examinations of Naval and Marine Corps Personnel: End Results—<i>Sidney A. Britten and Wilbur V. Charter</i>----	733
A Critique of Tuberculosis Control—<i>Harold A. Lyons</i>-----	739
A Review of 283,225 Chest Photofluorograms at the United States Naval Personnel Separation Center, Lido Beach, Long Island, N. Y.—<i>David F. Bew, Robert W. Tilney, Jr., and Walter E. J. Maher</i>-----	749
Long-Term Observation of Plasmodium Vivax Malaria in the Returned Serviceman; Part III—<i>Anthony A. Bianco, George M. Saunders, Arnold S. Levine, and Robert Cohn</i>-----	753
NOTES ON CONTRIBUTORS-----	766

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Fellow Officers of the Medical Department:

The first requirement of a medical officer in the Navy is to be a good doctor. Indeed, professional competence is the first consideration of every person in the Medical Department of the Navy, and every effort should be made to improve and increase our professional knowledge and skill.

However, it is also true that each one of us is a member of a military organization and we must have certain military habits and virtues. A knowledge of the customs and courtesies usual to the naval service, naval organization, naval history, and naval medical history; should form a part of the indoctrination of all members of the Medical Department of the Navy. Not only should these subjects be stressed in the instruction of all new members of the Medical Department in our hospitals and service schools, but each one of us should individually continue to increase our knowledge of these subjects.

Lack of good military background was responsible for much of the criticism aimed at the management of our Armed Forces, both during and after the war, and the knowledge of naval life and the practice of such military virtues as punctuality, courtesy, attention to duty, and responsibility for the safety, comfort, and efficiency of others should match our professional standards and accomplishments.

Sincerely,

C. A. Johnson

U. S. NAVAL MEDICAL BULLETIN

VOL. 47

JULY-AUGUST 1947

No. 4

*"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"*¹

SPECIAL ARTICLES



REPORT ON PRIMARY BONE GRAFTS

HERBERT C. FETT

Captain (MC) U. S. N. R.

and

JARVIS M. SMITH

Commander (MC) U. S. N. R.

This report is intended, in part, to supplement the article by Fett et al., in the September 1945 issue of the American Journal of Surgery on "The Problem of Delayed Union and Non-union of Fractures," in which one case of primary bone grafting was reported. That case is included to demonstrate end results. It represents the longest follow-up in this series, all of which have been fresh fractures at or about the junction of the middle and lower thirds of the tibia.

The use of primary bone grafts at the favored sites for delayed union and nonunion is not new and no originality is claimed. However, it became apparent at a large naval activity that the many cases treated by other methods frequently required union by bone grafts. Therefore, it seemed logical to use primary bone grafts as the best means of achieving a perfect end result in the shortest possible time. This is particularly advantageous in the armed services where loss of time from duty often runs into costly and fabulous figures.

The other methods referred to include simple closed reduction followed by plaster fixation, skeletal traction followed by plaster fixation,

¹ The policy of the U. S. Naval Medical Bulletin as printed on the cover of its first issue and maintained throughout the 40 years of its existence.

open reduction and plating, and open reduction with fixation by transfixing screws. Several cases were subsequently treated here which had originally been reduced and held by the Haynes, Stader, or Roger-Anderson splints while patients at other activities, but these splints were never used here in fresh fractures of the tibia as it was felt they were not suited for this type of fracture because of the risk of pin-hole infection and bone absorption about pins in the dense cortical bone of the tibia.

The idea of primary bone grafting may seem extremely radical to the average civilian surgeon, but we do not believe this attitude will prevail when careful consideration is given to the advantages gained. It has all the advantages of any open reduction and, in our experience, no added risks. Except in the case of marked comminution, a hair-line reduction should be easy to obtain and the fixation with a full-thickness sliding cortical graft is as rigid for all practical purposes as that obtained with a plate or transfixing screws. There should be no greater risk of infection than with any open procedure. Some surgeons might argue that the operation takes more time and, therefore, subjects the patient to greater risk. With standard equipment and technique we have found this time factor to be negligible. On the other hand, no one can deny the advantages of having a fresh bridge of bone across a fracture site, particularly where nonunion so often occurs. The fact that the patient may be saved a second operation is no mean consideration in itself and when we consider a possible gain of 3 to 6 months in the period of convalescence, primary bone grafting loses its radical appearance.

Our series consists of seven cases, totaling eight grafts. All were treated in the same manner. As early as possible after injury operation was performed. The patient was given a 24-hour skin preparation if there was any suspicion of unusual skin dirtiness and if the patient's comfort and general condition permitted that delay. All cases were done under sodium pentothal intravenous anesthesia. After preparing the area with ether, alcohol, and tincture of merthiolate, an 8-inch curved incision was made, the upper two-thirds of which was carried above the fracture site. This incision was curved medially to keep the skin scar away from the tibial crest. The incision was also carried directly to the bone so that the periosteum would remain attached to the overlying soft parts and facilitate its closure at the end of the operation. The skin edges were draped by using three wet towels, discarding that one which came in contact with the skin during the application of the towels. The towels were secured to the skin edges by Michel's clips. After stripping the periosteum down to the fracture site, all the extravasated blood and clots were evacuated. The fracture was then reduced, aiming at a hair-line reduction, and

the reduction was held with a Lowman clamp. Then using the electric saw (either the Albee or the Luck) the graft was cut from the proximal fragment about 5 inches long and five-eighths of an inch wide. The saw cut was made obliquely, completely through the cortex to the medullary canal to prevent the graft from sinking into the medullary canal later when fixed with screws.

A similar graft was cut from the distal fragment about one-half the length of the graft cut from the proximal fragment so that the latter could be accommodated across the fracture site. The graft from the proximal fragment was then slid down and secured with four Vitalium screws, two in each fragment. The bone removed from the distal fragment was then placed in the defect created in the proximal fragment by sliding the graft down. Screws of sufficient length were used to thoroughly grasp the opposite cortex. The Lowman clamp was removed and the reduction and fixation tested for strength and any soft tissue damage repaired as indicated. Occasionally the bone transferred from the distal to the proximal fragment would be held with an additional screw but this is not considered necessary. The periosteum and the soft parts were then closed with chromic No. 0 catgut and the skin closed with interrupted nylon No. 0 sutures of the Stewart type. The leg was then encased in plaster from the toes to the high thigh with the foot at 90° and about 30° of flexion at the knee.

No sulfonamides were used locally but all cases were treated with penicillin by intramuscular injection before and after operation as a precautionary measure. The total average dosage was 2,712,000 units. Three cases required new casts after swelling had subsided and primary immobilization was continued for 12 weeks in all cases, when recheck x-rays were taken and new casts applied if union was not sufficiently complete. Short walking plaster boots were applied when there was sufficient union to warrant weight bearing with support. All cases were done under an Esmarch band tourniquet applied high on the thigh. Three cases (Nos. 5, 6, and 7) were originally complicated. Case 5 had severe skin abrasions which delayed operation for 31 days after the patient was received at this hospital. Case 6 was primarily compounded by a small laceration not directly over the fracture site. A secondary closure of the laceration was performed on admission and the primary bone graft delayed until the superficial wound had thoroughly healed. Case 7 had bilateral fractures, one of which was compounded. The simple fracture was operated upon 12 days after admission but the compound fracture was delayed 57 days until healing of the soft tissue wound was thoroughly complete. This latter case can hardly be considered a primary bone graft and is included only because of the bilateral nature of the case.

No complications occurred in cases 6 and 7 and no complications have occurred in the other four grafts, but case 5 (originally complicated by skin abrasions) definitely became infected and in spite of treatment is still draining and required more surgery.

This case is not taken lightly and plainly illustrates the extreme care and caution needed in case selection when originally complicated by compounding or other potential infection and contamination. The infecting organism was hemolytic *Staphylococcus albus*. As Armstrong pointed out, "there are two contraindications to operation. The first is local infection in the affected limb, either of the skin, bone, or other tissues, or an active septic focus elsewhere in the body." It is felt, however, that the infection would have occurred with any open procedure and is not particularly due to the grafting. All cases but one had fractures of the fibula in addition to the tibial fractures. All were white males and averaged 28.75 years of age. As will be noted in the illustrations, the fractures were typical of the site, with varying degrees of angulation and overriding. No difficulty was experienced in accomplishing reduction in any case.

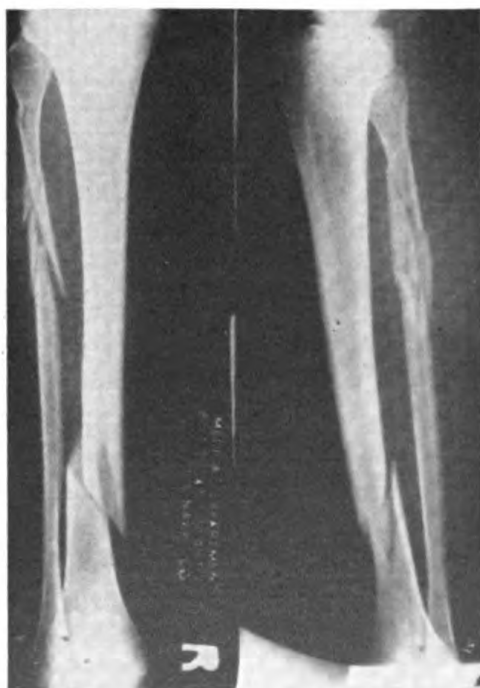


FIGURE 1.—Case 2. Illustration showing original fracture on admission. This good position was lost in an attempt to treat the case conservatively in plaster.

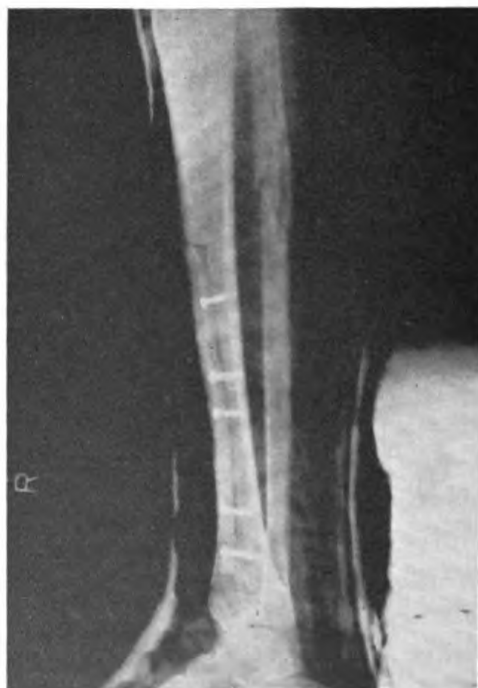


FIGURE 2.—Case 2. X-rays immediately postoperative showing the graft and method of fixation. Note that fracture line is barely visible and in this case the fill-in graft above is fixed with a single screw.

CASE REPORTS

Case 1.—C. H.—This patient, age 34, slipped and fell on the icy ground and sustained a simple spiral oblique fracture of the right tibia 6 inches above the ankle joint and a comminuted fracture of the fibula in its upper third on 23 December 1944. On 27 December 1944 a sliding bone graft operation was performed and a high thigh plaster cast applied. His progress to complete recovery was uneventful and he has since left the Navy for civilian life with no residual disability.

Case 2.—J. J. M.—This patient, age 23, fell on a slippery pavement on 7 August 1945 and sustained a simple fracture of the right tibia and fibula (fig. 1). On 14 August 1945 a sliding bone graft operation was performed (fig. 2) and a high thigh plaster cast applied. Sufficient union occurred by 20 November 1945 to permit the use of a short leg walking boot, and by 7 December 1945 he was walking without support. His progress to complete recovery was entirely satisfactory.

Case 3.—T. K.—This patient, age 25, stopped suddenly while running between bases during a baseball game and sustained a simple fracture of the right tibia without fracturing the fibula. The injury occurred on 12 September 1945 and on 14 September 1945 a sliding bone graft operation was performed. On 28 January 1946 weight bearing was started with support and by 21 March 1946 he was walking satisfactorily without support. Progress to recovery has been entirely satisfactory.

Case 4.—J. R.—This patient, age 44, was a veteran and on 31 October 1945 he was struck by a car, sustaining a simple fracture of the right tibia and fibula. On 7 November 1945 a sliding bone graft operation was performed. His progress to complete recovery has been entirely satisfactory and without complications.

Case 5.—J. H. S.—This patient, age 24, was involved in an automobile accident and sustained simple fractures of his left tibia and fibula complicated by marked pavement burn abrasions about the ankle and calf regions. The injury occurred on 28 October 1945 and operation was postponed until 28 November 1945 because of the condition of the skin. A sliding bone graft was performed. As mentioned before, this case has become complicated by infection which to date appears to stem from screw-hole sites. Bony union, however, has been excellent and he has been weight bearing since 24 December 1945. Solid bony union occurred despite the subsequent removal of both screws and graft remnant. However, he still drains a slight amount.

Case 6.—D. C.—This patient, age 21, was struck forcibly across the left leg by a 3-inch chain while hauling up his ship's anchor. The injury occurred on 28 October 1945 and consisted of a compound fracture of the left tibia and fibula. The wound was a clean laceration of the skin slightly below the fracture site and about three-fourths of an inch long. No bone protruded and there is some doubt that it was caused by the fragments. On admission to this activity, a secondary closure of the laceration was performed but the sliding bone graft was postponed until 30 November 1945 when the laceration had completely healed without evidence of infection. The subsequent progress to complete recovery has been entirely satisfactory and the danger of infection has definitely passed.

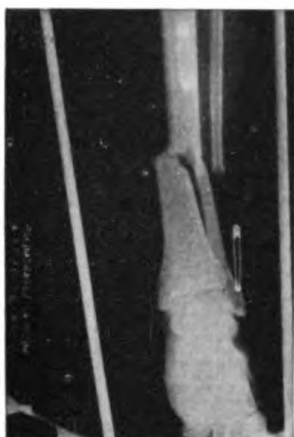


FIGURE 3.—Case 6.
Showing fracture on admission.



FIGURE 4.—Case 6.
X-rays taken 5 days postoperatively showing the graft and fixation. Note the free upper piece of graft not held by a screw in this case.



FIGURE 5.—Case 6.
X-rays taken 5½ months postoperatively. Note the solid bony union and synostosis.

Case 7.—R. B. H.—This patient, age 29, was struck by an automobile while crossing the street and sustained a compound fracture of the left tibia and fibula and a simple fracture of the right tibia and fibula. The injury occurred on 9 January 1946 and on 28 January 1946 a sliding bone graft operation was performed on the right side. When this patient was received at this activity both legs were encased in plaster and the plaster on the left side (the compounded side) was not disturbed to further insure against any possible contamination. By 13 March 1946 the soft parts had thoroughly healed on the left side and a sliding bone graft was performed. As stated before, this last operation is not considered a primary bone graft. Progress on the right side has been entirely satisfactory to date.

All except cases 5 and 7 received physiotherapy and active motion as soon as indicated but we have stressed active motion as being of the greatest value for rehabilitation. The discrepancies between the date of injury and date of operation in cases that were uncomplicated is due to the fact that the cases were not received at this activity immediately after injury. It should also be pointed out that length of hospitalization is not indicative of length of convalescence, since in the service patients are not returned to full duty until absolutely all evidences of disability have long since disappeared and usually only after the patient has had his convalescent leave.

SUMMARY

Seven cases totaling eight fractures of the tibia at the junction of the lower and middle thirds are presented. All except one were treated by open reduction and fixation with a primary sliding bone

graft followed by plaster immobilization. The authors were attracted to this method by the frequent occurrence of nonunion and delayed union at this important weight-bearing site when other methods were used. One serious complication occurred but otherwise the results to date seem to justify this choice of treatment. It is especially noteworthy that none of the classic signs of nonunion or delayed union (i. e., cupping, sclerosing, cortical thinning, etc.) have been noted. Since nonunion and delayed union cannot be predicted, selection of cases is not particularly necessary unless there are other contraindications to surgery. With the return of the automobile to the road and the increasing number of industrial accidents, this method of treatment will find more opportunity for application and offers a means to a perfect result without the fear of nonunion, delayed union, and malunion.

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EFFECT OF ROENTGEN RAYS ON CELLULAR DIVISION

"While mitotic counts give important data on the effect of Roentgen rays on growing tissue, this method fails in the investigation of behavior of full-grown tissue. The effect of ionizing irradiation on all types of tissue can be studied by determining the amount of newly formed desoxyribonucleic acid before and after irradiation. The newly formed nucleic acid is determined by using radioactive P as an indicator. Therapeutic and larger doses of Roentgen rays inhibit the formation of desoxyribonucleic acid in the growing and full-grown tissues to about the same extent. A large percentage (about three-fourths of the inhibiting action disappears within 2 hours after irradiation. The difference between growing and grown tissues is interpreted by assuming that a far longer time elapses for an average full-grown tissue cell to reach the mitotic stage and thus to have a greater chance to regenerate from the damaging influence of the irradiation. The problem of direct and indirect action of Roentgen rays on cell division is discussed."—HEVESY, G. (Univ. Stockholm): *Rev. Modern Phys.* 17: 102-11 (1945). *Chemical Abstracts* 40: No. 10, p. 2858, May 20, 1946.

JAPANESE "B" ENCEPHALITIS

Epidemiological Report of the 1945 Outbreak on Okinawa

WILLIAM E. MOSHER, JR.¹

Lieutenant Commander (MC) U. S. N. R.

During the summer of 1945, 91 cases of acute encephalitis occurred among the natives of Okinawa and 36 cases occurred on the neighboring islands of Heanza and Hamahika in the Ryukyu Archipelago. The diagnosis was established by the isolation of the Japanese "B" encephalitis virus from the brain of a fatal case (1) and from the pathological and serological studies.

The existence of the disease was of immediate military importance to American forces in view of the contemplated invasion of Japan, scheduled for late autumn, and the importance of the island of Okinawa as a military base. Because of their medical interest, the cases were studied by several groups of investigators, including the Military Government Research Center, the Naval Medical Research Unit No. 2, and the Neurotrophic Virus Commission of the Army Epidemiological Board. The laboratory aspects of these investigations are being published elsewhere. A complete report of the clinical and laboratory findings on the cases admitted to the Research Center is being separately submitted (2). This report will be devoted to a description of the epidemiological features of the outbreaks on the two islands. Although the conditions under which the studies were made precluded detailed field observations, the available data are considered to be worthy of recording for two reasons: (a) The correct interpretation of laboratory results depends upon knowledge of the field conditions under which the cases occurred; (b) there is very little information regarding the epidemiological aspects of Japanese "B" encephalitis recorded in the medical literature.

BACKGROUND INFORMATION

Description of the islands

Okinawa is an island 43 miles long and $\frac{3}{4}$ to 10 miles wide, and the population in 1945 was estimated to be approximately 300,000

¹ Formerly epidemiologist of the Military Government Research Center, Okinawa.

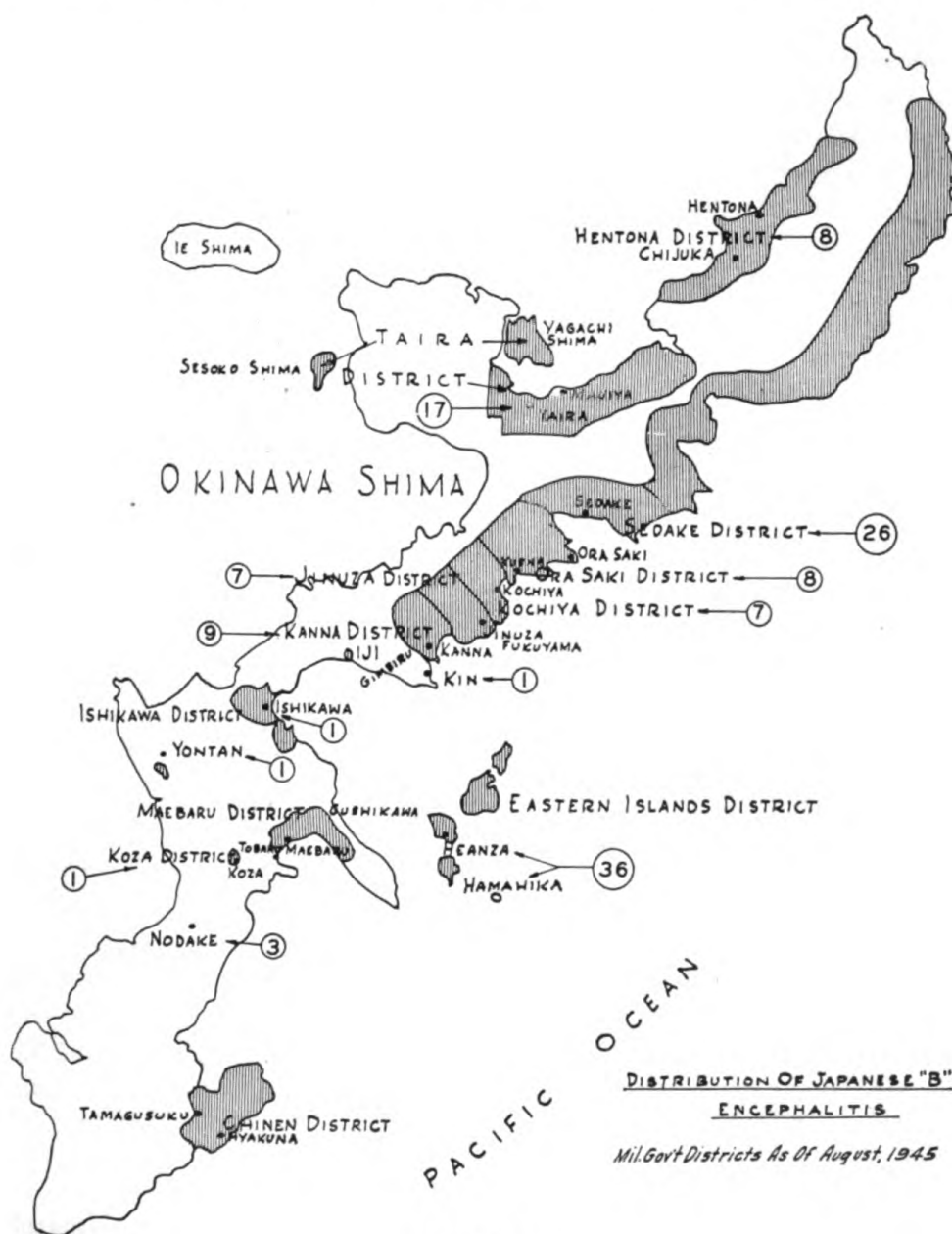


FIGURE 1

persons. Prior to the invasion, the majority of the inhabitants lived in the southern third of the island which contained most of the arable land. The remainder of the island in the north was extremely mountainous, and heavily wooded and only sparsely settled.

The invasion of Okinawa began on 1 April and by 15 July military government had established centers for the care of natives, the majority of which were located in northern Okinawa. Many were evacuated from combat areas or areas restricted for military purposes. Between

1 June and 20 July 1945 about half of the total population, 150,000 natives, were evacuated from the southern end of the island to Districts in the middle and northern regions. Approximately 100,000 natives remained in the south in the Koza, Maebaru, and Chinen Districts. No natives were living outside of military government districts by the first of August with the exception of a few thousand refugees and soldiers in the mountainous areas of the north, and these people drifted slowly into the Sedake, Taira, and Hentona Districts during the summer. The distribution of native populations as of 5 August 1945 is indicated on the map (fig. 1) and in table 1.

TABLE 1.—*Distribution of cases of Japanese "B" encephalitis by district and by month, and attack rates per 10,000 population by districts*

	Number cases			Total	Population	Attack rate per 10,000 population
	July	Aug.	Sept.			
Northern:						
Sedake.....	7	14	5	26	16,689	15.6
Taira.....	7	9	1	17	61,937	2.7
Hentona.....	0	8	0	8	26,466	3.0
Total.....	14	31	6	51	105,092	4.9
Central:						
Kanna.....	7	2	0	9	28,495	3.2
Jinuza.....	7	0	0	7	31,157	2.2
Kochiya.....	5	1	1	7	12,577	5.5
Ora-Saki.....	6	2	0	8	32,298	2.5
Kin—civilians evacuated.....	1	0	0	1	(1)	
Total.....	26	5	1	32	104,527	3.0
Southern:						
Maebaru.....	0	0	0	0	42,453	
Chinen.....	0	0	0	0	24,770	
Nodake.....	3	0	0	3	8,965	3.3
Ishikawa.....	1	0	0	1	24,631	.4
Koza.....	0	1	0	1	11,659	.9
South areas—civilians evacuated.....	3	0	0	3	(1)	
Total.....	7	1	0	8	112,478	.7
Grand total.....	47	37	7	91	322,097	4.1

¹ Native census as of 7 Aug. 1946.

The islands of Heanza and Hamahika are situated approximately 3 miles from the southeastern shores of Okinawa. These islands were inhabited by approximately 36,000 natives and were occupied with little opposition. Following occupation, there was practically no contact with natives on Okinawa as a result of military restrictions. During June and early July, all the natives on Hamahika were moved to Heanza Shima.

Case finding

The first cases were recognized on 8 July 1945 by Lt. L. M. Miller (MC) U. S. N. R. of the Military Government on Heanza Shima. Two

days later, four patients confined in a tetanus ward of a military government hospital at Jizuza, Okinawa, were diagnosed as encephalitis by Lt. Comdr. Leon Lewis (MC) U. S. N. R.

Subsequently, the investigation of encephalitis on Okinawa was assigned to the Military Government Research Center, and on 18 July, an isolation hospital for the study of the disease was opened at Gimbiru. By the direction of the commandant of the U. S. military government, all patients with cerebrospinal symptoms suggestive of encephalitis were referred to the Research Center from all parts of the island, by field dispensaries, hospitals, and other medical units established to care for the natives. Dispensary personnel was instructed in the recognition of the disease, and in some areas, native police assisted in finding the sick. A visiting nurse program was instituted by some of the dispensaries. While these nurses were largely untrained volunteers, they facilitated in some degree the case finding and referral of cases to the hospitals.

In order to supplement the case finding of the field dispensaries and to secure more adequate data regarding the incidence of the disease, an epidemiologist was assigned to the Research Center early in July. His time was devoted largely to case finding and to securing more adequate epidemiological data in regard to cases hospitalized. During the period 8 July to 1 October, the epidemiologist assisted by his interpreter made hut-to-hut visits in eight military government districts. Superficial examinations were made of all those who were found ill in these dwellings. Those ill were questioned as to symptoms and basic epidemiological data. Because of the language barrier, these interviews were not entirely satisfactory. In the densely populated living centers, it was possible to visit as many as 200 huts a day which accommodated from 20 to 60 persons. A special effort was made to discover sub-clinical infections.

An ambulance accompanied the epidemiologist in order to facilitate the immediate removal of new cases to the isolation hospital and to prevent case loss, as it was the practice of many families to hide their sick soon after they were discovered, hoping to prevent their being hospitalized. Cases were occasionally surreptitiously removed from local dispensaries at night when the American personnel withdrew for security reasons.

Between early July and 2 October, a total of 91 patients were diagnosed as encephalitis among the natives of Okinawa. Among these, 44 were referred from field dispensaries and other medical units. Twenty-two were referred directly by the epidemiologist from the field, 15 were diagnosed and studied independently at naval G6 hospitals, and 10 were diagnosed by the epidemiologist in the field but not hospitalized. Concurrent with the study on Okinawa, Epidemiology

Unit G-18 No. 311 under the command of Lt. Comdr. Walter Kees was studying an epidemic of encephalitis on Heanza and Hamahika Shima where 36 cases were reported (3).

Population data

Incidence rates and mortality rates are based upon the census of military districts, taken by the military government on 1 August, a time when the redistribution of the natives was substantially completed. The age distribution of the population is based on a more detailed census in two Okinawan civilian encampments, C-2 and C-18-X, with a total population of 18,682. Although this is a rather small sample of the total, it is believed that it was reasonably representative of the native population on the whole island. Similar findings were found in the Kanna District as a result of a nutritional survey.

DESCRIPTION OF THE EPIDEMIC

Fairly reliable data have been secured as to the onsets of illness in all but one of the cases studied with the earliest reported onset on 3 July and the last on 2 October. A tabulation of the dates of onsets by weeks is presented in table 2 and figure 2. The higher incidence occurred during the first 4 weeks of July, due in large part to the concentration of cases during this period on the islands of Heanza-Hamahika. Cases continued in moderate numbers through August on Okinawa and a few cases were reported in the month of September. The majority of cases on Okinawa (47) became ill during the month of July while only 6 scattered cases were reported during September.

TABLE 2.—*Dates of onsets grouped by weeks in natives on Okinawa and Heanza-Hamahika*

Weeks	Natives		Total	Weeks	Natives		Total
	Oki-nawa	Heanza-Hama-hika			Oki-nawa	Heanza-Hama-hika	
July 1-7.....	8	10	18	Sept. 2-8.....	2	0	2
July 8-14.....	15	13	28	Sept. 9-15.....	1	0	1
July 15-21.....	10	10	20	Sept. 16-22.....	2	0	2
July 22-28.....	12	2	14	Sept. 23-29.....	0	0	0
July 29-Aug. 4.....	9	0	9	Sept. 30-Oct. 5.....	1	0	1
Aug. 5-11.....	9	0	9	Unknown.....	1	1	2
Aug. 12-18.....	13	0	13				
Aug. 19-25.....	4	0	4				
Aug. 26-Sept. 1.....	4	0	4				
				Total.....	91	36	127

The morbidity rate for the island of Okinawa was 4.1 per 10,000 as compared with 44.7 for Heanza-Hamahika Shima. It is questionable whether this rate is indicative of a definite epidemic prevalence of encephalitis or whether it indicates a normal seasonal prevalence. The

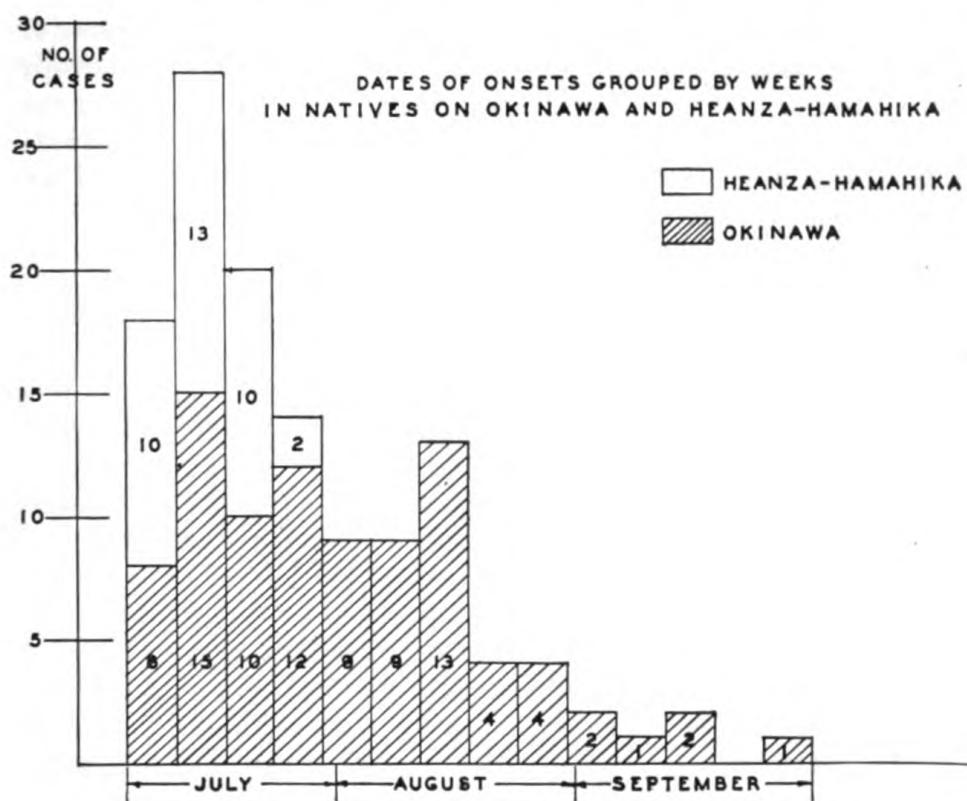


FIGURE 2

lack of comparable data for previous years makes a determination of this question impossible. However, native physicians reported that similar epidemics have occurred almost every year and that epidemics of sizable proportions were observed every few years. The native doctors did not consider the prevalence during the summer of 1945 unusual.

Of the 91 cases recognized on Okinawa, 26 died, constituting a case fatality rate of 28.6 percent and a mortality rate of 0.8 per 100,000 population as shown in table 3. This rate is comparable with death rates reported in Japan between 1927-37 (4). On Okinawa 81 percent of the 26 deaths were subjects under 15 years of age.

TABLE 3.—*Distribution of deaths, case fatality rates and death rates for natives on Okinawa and Heanza-Hamahika, 1945*

	Cases	Deaths	Death rate per 100,000 population
Okinawa.....	91	26	0.8
Heanza-Hamahika.....	36	11	13.8
Total.....	127	37	1.1

On the islands of Heanza and Hamahika, there were 36 cases and 11 deaths, making a case fatality rate of 30.5 percent and a mortality rate of 13.8 per 100,000 population. The high morbidity rate of these islands and the sharp restriction of the cases to the 4-week period in July would indicate that in these islands a definite epidemic of encephalitis had occurred.

Incubation period

Epidemiological data on three cases offer suggestive but not conclusive evidence as to the duration of the incubation period of Japanese "B" encephalitis. One child was shipped by LST from the Chinen peninsula in the south to the village of Oura on 24 July. His illness began on 5 August, 12 days later. A second child was transferred from the Chinen peninsula to Oura on 5 August and became ill on 16 August, 11 days later. The village of Oura was an endemic center with an attack rate of 18 cases per 10,000 persons and was but 3 miles from Sedake. A third child, moved from Atanniya in the south of the island to Nakagawa on 2 July, had onset of her infection 11 days later. No cases of encephalitis were reported from the Chinen peninsula or Atanniya. Nakagawa claimed five cases of encephalitis during July and August. This suggests that the incubation period is less than 14 days which is in agreement with the opinions of most authorities.

Age distribution

Our limited experience during the summer of 1945 indicates that this is largely a disease of children and young adults in the Ryukyus. Of the 91 cases studied, all but 11 were under 20 years of age, with 7 patients in the age group between 20 and 29. There were 35 cases (38.4 percent) in the age group, 5-9. This is consistent with prior verbally reported observations of Okinawan physicians, as well as Iimura (5) who noted that only in the Ryukyus Islands (Okinawa) and in Formosa did the larger number of cases occur in children. On Heanza Shima, 63.8 percent of the cases were under 20 years.

Table 4 is a tabulation of the cases in the Heanza-Hamahika and Okinawa outbreaks by age groups. The peculiar age distribution of this population is of interest and is attributable to Japanese military and labor conscription, which resulted in a loss of both male and female young adults from these islands.

Geographic distribution of cases

The incidence of cases by month in each of the military government districts is presented in table 1. The main foci of infection appeared to be in the northern and middle eastern districts where 83 of the 91 cases of encephalitis resided during the probable incubation period of the disease. Only 5 cases were recognized in the southern Districts of

Malbaru, Chinen, Nodake, and Ishikawa and 3 additional cases probably contracted their infections before leaving the southern areas from which they were evacuated. The attack rate in the south was 0.7 cases per 10,000 as compared with 4.9 per 10,000 in the 3 northern Districts and 3.0 in the middle eastern districts (table 1). Although case finding surveys were not conducted in the south by the epidemiologist, the native population was more stabilized in the southern areas with better medical facilities for recognition of cases.

TABLE 4.—Age incidence of Japanese "B" encephalitis among natives on Okinawa and Heanza-Hamahika Islands

Age group	Number of cases		Total	Percentage distribution of cases	Percentage distribution of population ¹	Cases per 100,000 by age group
	Okinawa	Heanza-Hamahika				
Under 5 years.....	10	3	13	10.2	12.95	30.3
5 to 9 years.....	35	7	42	33.1	15.66	81.0
10 to 14 years.....	27	10	37	29.1	14.45	75.5
15 to 19 years.....	8	3	11	8.7	5.59	56.3
20 to 29 years.....	7	2	9	7.1	7.73	35.3
30 to 39 years.....	2	2	4	3.1	7.44	16.3
40 to 49 years.....	1	2	3	2.4	8.99	10.1
Over 50 years.....	1	7	8	6.3	27.17	8.9
Total.....	91	36	127	100.0	100.00	38.5

¹ Estimates of population distribution based on studies of 2 Okinawan communities with a total population of 18,682 by the welfare division of military government.

In the northern Districts, the peak incidence occurred in August with 31 cases compared to only 14 in July. The northern Districts of Sedake, Hentona, and Taira accounted for 51 (56 percent) of the cases. The highest incidence occurred in Sedake with an attack rate of 15.6 per 10,000 population. It is apparent from the data in table 1 that the cases of Japanese "B" encephalitis continued throughout the summer months in the northern Districts, but were restricted almost entirely to the month of July in the central and southern Districts.

MOSQUITO PREVALENCE AND CONTROL

Japanese and Russian workers have demonstrated that the virus of Japanese "B" encephalitis can be transmitted by the mosquito in the laboratory. Mitamura et al. (6) claim to have detected Japanese "B" virus in *Culex tritaeniorhynchus* and *Culex pipiens* in nature. In addition to these, it has been demonstrated that *Aedes albopictus*, *Aedes japonicus*, and *Aedes togoi* Theobald are capable of transmitting the disease to mice or monkeys in the laboratory (7) (8). Hammon and Reeves (9) also claim experimental transmission of the disease with *Culex pipiens*, *Culex quinquefasciatus*, *Culex tarsalis*, *Aedes lateralis*, *Aedes nigromaculatus*, and two species of the genus *Culiseta*.

During the summer, collections of mosquitoes as well as other possible insect vectors were made by Army and Navy entomologists. Hodes, Thomas and Peck (10) report that the virus of Japanese "B" encephalitis was not recovered from a total of over 5,000 mosquitoes, 800 biting flies (*Stomoxys calcitrans*), and 1,500 mites.

It was observed that the highest incidence of Japanese "B" encephalitis occurred in area where mosquito control measures had not been instituted or were ineffective. In the Districts of Kanna, Jinuza, Kochiya, and Ora-Saki, which roughly occupy the middle third of the island, mosquito control measures were vigorously instituted in late July and early August. Six power sprayers were used in these areas, and airplane spraying, begun in late July, was continued through August and September. Only 6 cases of encephalitis were reported in these districts during August and September as compared with 26 cases during July (table 1).

The Districts of Taira, Hentona, and Sedake occupying the northern third of the island accounted for the majority of cases (37) of encephalitis reported in August and September. Power sprayers were first used in the Sedake district about the middle of August, but spraying from planes was not started until 6 September. The Taira District instituted control measures in early August and received plane coverage for the first time on 13 August. Effective mosquito control was not instituted in the Hentona area until 28 August although plane spraying was started on 13 August. The Sedake and Hentona Districts received the poorest plane coverage of any of the military government areas. The extremely mountainous terrain in the northern third of the island and the numerous rice paddies on the eastern shore make mosquito control difficult and plane spraying ineffectual.

The geographical distribution of the military cases is also of considerable epidemiological significance. Sabin reported all the serologically proved cases of Japanese "B" encephalitis occurred in the troops which were stationed in the northern third of Okinawa during July, August, and September (11). Several thousand natives were living in the mountains in close proximity to the troops. The majority of these soldiers lived in shelter tents, and individual mosquito protection measures were not effective as is evidenced by a fairly high rate of malaria in this division.

Mosquito control was instituted early in the campaign in southern Okinawa where the vast majority of our troops were stationed. DDT spraying from planes was begun early in April over the battle fronts. The southern Districts of Maebaru, Koza, Chinen, and Ishikawa were given intensive coverage along with the areas where troops were stationed. Only six cases of encephalitis were reported in the native areas, and no troop cases were reported in the southern third of the island.

The experience with the disease on Heanza-Shima is of interest as there appears to be a direct relation between the institution of mosquito control measures and the cessation of the epidemic. Intensive ground control was first instituted on this island early in July soon after the first case of encephalitis was reported. Airplane spraying was started on 14 June and continued through the summer months. Entomologists were able to find but few mosquitoes on this island late in July. The last reported case of encephalitis on Heanza Shima was 25 July.

DISCUSSION

The recognition of clinical encephalitis on Okinawa, Heanza, and Hamahika Shima early in July 1945 was of considerable interest to American investigators as it was their first opportunity to study Japanese "B" encephalitis. Although the Japanese had reported the "B" type of encephalitis as epidemic in Formosa and in the Ryukyu Islands, there was not evidence in the literature that there had been extensive epidemics on Okinawa or neighboring islands. Nor was it established that the encephalitis which occurred here was caused by the virus isolated in the Japanese epidemics. It seems probable that the outbreak of the summer of 1945 was due almost wholly, if not entirely, to the Japanese "B" type of virus because of the isolation of this type from the brain of a fatal case and the demonstration of antibody responses by complement-fixation and neutralization tests in a number of the recovered cases (1) (11).

It also seems probable that the incidence of cases on Okinawa in all but at least one District was essentially the normal expected endemic incidence during the summer season. Local physicians reported the occurrence of similar cases in previous years. Furthermore, the age distribution of recognized cases on Okinawa strongly suggests the occurrence of this disease in a partially immunized population. Considerably higher incidence rates were observed among young adults than among older people. It seems probable that this disease was endemic in these regions and had been so for a long period of time. Further evidence supporting this concept was obtained by Thomas et al. who found neutralizing antibodies to Japanese "B" encephalitis virus present in 84 percent of natives over 11 years of age, but in only 13 percent of children 10 years of age or younger (12). Sabin (11) also found in a study of natives with no history of encephalitis, the presence of antibodies in 90 percent of 30 persons over 20 years of age, 55 percent of 11 persons in the 10 to 19 year age group, and completely negative results in the 16 children under 10 years. In the District of Sedake on the island of Okinawa and on the islands of Heanza and Hamahika Shima, it seems probable that the incidence reached epidemic proportions.

It is recognized that the present study gives only the roughest measure of the incidence of the disease in this area. It was not possible to undertake intensive studies of minor illnesses to determine the occurrence and frequency of inapparent infections. The high proportion of neutralizing antibodies in the sera of adults in the population suggests that such mild illnesses may have been quite frequent.

The high rate in the northern and central Districts in Okinawa in contrast to the low rates in the southern Districts and the continuance of the disease in August and September in certain of the northern Districts are epidemiological observations which are believed to have considerable significance. Although no surveys were made by the epidemiologist in the southern Districts, it is believed that the more stabilized populations and the better medical facilities in these areas served to equalize the case-finding activities in the northern and middle Districts. Therefore, the disappearance of the disease from the southern part of the island and from the island of Heanza Shima is believed to be valid.

One logical explanation for these epidemiological findings is the effectiveness of the mosquito control measures in the various Districts. The incidence of cases on the island of Heanza Shima subsided abruptly 2 to 3 weeks following the introduction of intensive mosquito control measures. In the middle and northern sections of the island, these measures were undertaken later in the summer; and particularly in the Sedake District, they were much less effective due to mountainous terrain which made airplane dusting ineffective. These findings are consistent with the hypothesis that the vector of Japanese "B" encephalitis on Okinawa was one or more species of the mosquito.

SUMMARY

1. An outbreak of Japanese "B" encephalitis occurred in the native population of Okinawa and Heanza-Hamahika Shima during July, August, and September 1945.

2. The morbidity rate for the island of Okinawa was 4.1 per 10,000 population as compared with 44.7 for Heanza-Hamahika Shima. There were 26 deaths on Okinawa with 11 deaths in the 36 cases reported on Heanza-Hamahika Shima.

3. Based on these observations, this disease appeared to be one of childhood on Okinawa with 81 of the cases under 20 years of age.

4. Of the 91 cases reported on Okinawa, 51 occurred in the northern Districts where mosquito control measures were least effective and only 8 in the southern Districts where mosquito control work was conducted on a large scale by the Army and Navy.

5. The epidemic on Heanza Shima subsided abruptly following introduction of intensive mosquito control measures suggesting that the vector may have been one or more species of mosquito.

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A MEDICAL SURVEY OF ALLIED REPATRIATES AFTER LIBERATION FROM JAPANESE PRISONS

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The physical status of a group of young, white, male adults after they had experienced 3 to 4 years of malnutrition and hardship is of general medical interest. In addition, the physical status of repatriates should be of interest as an index of the care received by Allied prisoners while in the hands of the enemy.

This report is based on the clinical and laboratory findings in 325 Allied repatriates as they were processed medically at a United States fleet hospital 12 to 15 days after their liberation. The data presented are the results of the combined efforts of the entire professional staff of the hospital.

The prime purpose of the medical processing of repatriates was to determine their physical fitness for travel to the United States and to obviate the introduction of public health hazards into the United States. Many men with obvious disabilities requiring hospitalization were not retained at the fleet hospital, for it was felt that if their condition warranted travel they should be returned to the United States as soon as possible for hospitalization there. On the other hand, a number of repatriates well enough to travel were held for treatment of intestinal parasites as a public health measure.

METHOD OF PROCESSING

All repatriates included in this study arrived at the U. S. Fleet Hospital No. 111 at Guam, Marianna Islands, in September 1945, having been liberated from Japanese prisons 12 to 15 days previously. A routine for medical processing had been established prior to the arrival of the men, and this was followed closely with few exceptions. Upon their arrival at the hospital a careful history was taken. Particular regard was given to those diseases encountered in prison which resulted in hospitalization or incapacitation. The history was followed in each case by a general physical examination. Routine laboratory procedures included a chest x-ray, hemoglobin determination,

*Resigned.

urine and stool examinations, and blood Kahn. When they were specifically indicated, certain other laboratory procedures were done; thus, all patients with a hemoglobin below 11.5 grams (80 percent) received a red blood cell count.

The group of men examined included both American and Canadian service personnel and a small number of civilians. Of the 325 men processed, there were 129 American enlisted men and 48 American officers, 135 Canadian enlisted men and 1 Canadian officer and 12 civilians. The average age of all repatriates examined was 29.7 years. The oldest man was 54, and the youngest man was 19. The average period of internment for the group was 41.4 months. The longest period was 44 months, and the shortest period was 1.5 months. All Canadians processed had been prisoners for 44 months, since the fall of Hong Kong.

HISTORY

Table 1 is a compilation of the various diseases reported by the repatriates which resulted in hospitalization and/or incapacitation during their internment. The actual number of hospitalizations is not reflected in the number reported or in the percent reporting, for in many instances of diseases such as beriberi, malaria, and dysentery, many men had more than one period of hospitalization. The term *dysentery*, as it is used here, includes both amebic and bacillary dysentery, and any severe diarrhea which resulted in hospitalization or incapacitation. A number of men with dysentery had been told that their stools contained amebae, but in most instances the etiological agent was unknown to the patient.

TABLE 1.—Incidence of incapacitating disease and disease requiring hospitalization during internment

Disease	Number reporting	Percent reporting	Disease	Number reporting	Percent reporting
Dysentery.....	184	56.43	Rheumatic fever.....	4	1.23
Beriberi.....	136	41.84	Tonsillitis.....	4	1.23
Malaria.....	77	23.67	Dermatitis (type not specified).....	4	1.23
Avitaminosis ¹	49	15.07	Bronchitis.....	4	1.23
Diphtheria.....	40	12.30	Appendicitis.....	3	.92
Pneumonia.....	37	11.38	Peptic ulcer.....	2	.61
Jaundice.....	24	7.38	Scurvy.....	1	.30
Malnutrition.....	19	5.84	Otitis media.....	1	.30
Pellagra.....	18	5.53	Catarrhal fever.....	1	.30
Defective vision or loss of vision.....	16	4.92	Asthma.....	1	.30
Pleurisy.....	12	3.69	Scarlet fever.....	1	.30
Dengue.....	11	3.38	Pharyngitis.....	1	.30
Fever of undetermined origin.....	7	2.15	Empyema.....	1	.30
Chilblain.....	7	2.15	Chicken pox.....	1	.30
Influenza.....	6	1.84	Arthritis (type not specified).....	1	.30
Mumps.....	4	1.23	No disease.....	27	8.30

¹ The term avitaminosis is that used by the reporting repatriate. No attempt was made to define this term more clearly.

A distinction must be made between disease resulting in hospitalization and disease resulting in incapacitation. The men examined were liberated from several different prisons, and almost all of them had been in more than one prison. The type of care given to prisoners varied in different camps. Some men reported that in certain prisons it was standard treatment for the guards to beat each patient reporting to the dispensary for medical care before he received treatment, and again after he received treatment. Such brutality certainly is calculated to reduce the number of men reporting for treatment. It is reasonable to assume, therefore, that some incapacitating diseases did not result in hospitalization.

The high incidence of beriberi reported aroused the curiosity of examining physicians and made one wonder if the patient was correct in stating that he had suffered from that disease. On close questioning, the patient's description of his symptoms could leave little doubt that he had experienced true beriberi. The occurrence of edema and paresthesias in epidemic form among personnel subsisting almost exclusively on a rice diet could hardly be attributed to any other disease. It is of particular interest that of the 325 repatriates, 254, or 72 percent reported incapacitation due to deficiency diseases; namely beriberi, avitaminosis, malnutrition, or pellagra. Scurvy was reported by name in only one instance. Undoubtedly the remaining 91 men suffered mild or moderate deficiency states.

The incidence of diphtheria during internment was quite high among these men. All 40 cases occurred in epidemic form among Canadians in one camp. Some were treated with serum; others received no serum. The incidence of malaria was likewise rather high, but many men reported that their original inoculation took place before they became prisoners, and that subsequent hospitalizations were for recurrences.

In 138 instances the examining physician questioned the patient specifically about weight loss. One hundred thirty-one men reported weight loss varying from 10 pounds to 122 pounds. Of those questioned, only 7 reported no weight loss. The average loss of weight during internment was 45 pounds. In nearly all men the most marked loss occurred during the first few months of imprisonment; the weight then leveled off and remained fairly constant. A number of men reported that some specific illness, such as pneumonia, was the principal cause for weight loss. During the 12 to 15 days en route to the fleet hospital, all patients were subsisted on an Occidental diet with accessory vitamin intake, and during this period almost all of the men gained 10 to 15 pounds.

PHYSICAL EXAMINATION

The more significant findings on physical examination of the repatriates are outlined in table 2.

TABLE 2.—*Significant findings on physical examination of 325 Allied repatriates*

Physical findings	Number	Percent	Physical findings	Number	Percent
Edema of the lower extremities	87	26.7	Fungus infection of skin	6	1.8
Malnutrition	76	23.3	Chronic ulcers of legs	6	1.8
Defective vision	36	11.0	Ascites	6	1.8
Tachycardia	35	10.7	Bronchitis	5	1.5
Hepatomegaly	31	9.5	Skin lesions (type not specified)	5	1.5
Glossitis	17	5.2	Defective hearing	4	1.2
Paresthesias (objective neurological findings not recorded)	17	5.2	Cheliosis	4	1.2
Anemia	6	1.8	Impetigo	4	1.2
Millaria	6	1.8	Hypertension	3	.9

The examinations were done by a number of observers and the time allowed for a single examination was limited. It is likely, therefore, that some less obvious abnormalities were overlooked.

As one would expect, the most frequently encountered abnormalities were those which reflected deficiency states. Edema of the lower extremities was noted in 87 men; of these, 17 complained of paresthesias. Unfortunately, laboratory facilities were not available for the determination of plasma protein and vitamin levels, and the significance of edema was based entirely upon the clinical judgment of the individual examiner. Certainly the finding of edema meant deficiency disease. Whether one chooses to call these cases beriberi or simple hypoproteinemia is a matter of opinion. Although sensory examinations were not done in the majority of these cases, it is felt that those men with edema who complained of paresthesias were cases of beriberi.

LABORATORY DATA

Blood

The significance attached to the hemoglobin levels of the repatriates should be influenced by three factors. First, the men with severe anemia were transfused en route to the fleet hospital, a few receiving two transfusions of 500 cc. of whole blood. Second, during this period all of the men were subsisted on a high protein diet, and the effect of this diet on hemoglobin levels can only be surmised. Third, the Tallqvist method of hemoglobin determination was used because of the rapidity with which large numbers of men could be examined. The fallibility of this method is known.

Hemoglobin determinations were done on 304 men, and the average was 82.4 percent, or 11.9 grams. No definite relation between hemoglobin level and period of internment could be established.

Red blood cell counts were done in 27 cases because the routine hemoglobin determination was below 80 percent (11.6 grams). Of this group, the average hemoglobin was 71.8 percent (10.4 grams), and the average red blood count was 3.4 million. The average color index for this group was 1.02. Eleven of the twenty-seven men had color indices above 1.1, while in only one instance was the index below 0.9. In 15 cases the anemia was normochromic.

Urine

Routine examination of a single urine specimen was done in 319 cases. This examination consisted of specific gravity determination, the Benedict test for sugar, the Exton test for albumin, and a microscopic examination of centrifuged urinary sediment. Pyuria, varying from several to numerous white blood cells per highpower field, was found in 49 cases (14.8 percent). Red blood cells were noted in only 5 specimens, and casts in only two. The Benedict test was positive in 18 urine examinations, varying from a trace to 2 plus, but the specimens were not repeated, and the time interval between food intake and collection of the specimen was not recorded. Blood sugar levels were not determined.

In only seven cases was albuminuria reported, and in no instance did this exceed a 2 plus reaction.

Stool

A single examination for ova and parasites was done in 320 cases, and in 221 cases the stool examination was reported negative. Table 3 shows the findings in the 104 specimens which were reported positive. Many of those stools which were reported negative probably would have shown positive findings on repeated examinations.

TABLE 3

Parasite	Number of cases	Percent of repatriates	Parasite	Number of cases	Percent of repatriates
<i>Ascaris lumbricoides</i>	99	30.9	<i>Trichuris trichiura</i>	4	1.2
<i>Endamoeba histolytica</i>	6	1.8	<i>Ancylostomidae</i>	4	1.2
<i>Chilomastix mesnili</i>	5	1.5	<i>Strongyloides stercoralis</i>	4	1.2
<i>Giardia lamblia</i>	4	1.2	<i>Trichomonas hominis</i>	2	.6

Chest x-ray.—Chest x-ray reports were available in 319 instances. Table 4 summarizes the pulmonary pathology of importance. It is based entirely upon roentgenological interpretation.

TABLE 4

Roentgenological diagnosis	Number of cases	Percent of repatriates	Roentgenological diagnosis	Number of cases	Percent of repatriates
Multiple fibrous strands.....	12	3.76	Pneumonia.....	3	.93
Probably active tuberculosis..	11	3.44	Pulmonary fibrosis.....	2	.62
Pleural thickening.....	11	3.44	Pleural effusion.....	2	.62
Tuberculosis (activity undetermined).....	9	2.82	Atelectasis.....	1	.31

Cardiac abnormalities were not reported in any instance. Cardiac enlargement, which might be expected in some cases diagnosed clinically as beriberi, was not reported.

CAUSES FOR HOSPITAL ADMISSIONS

One hundred fourteen men, or 35 percent of all repatriates processed, were admitted to the hospital wards as patients. The majority of these cases were admitted for intestinal parasitism; the remainder required treatment or observation before being allowed to travel to the United States for subsequent hospitalization. Table 5 summarizes the causes for admission. The apparent discrepancy between the number of men admitted to the hospital and the number of causes for admission, listed below, is explained by the fact that a number of patients were admitted with multiple diagnoses.

TABLE 5

Causes for admission	Number of cases	Percent of repatriates	Causes for admission	Number of cases	Percent of repatriates
Ascariasis.....	95	29.10	Pleurisy with effusion.....	2	.61
Malnutrition.....	20	6.15	Syphilis.....	2	.61
Beriberi.....	12	3.69	Hepatitis, acute.....	1	.30
Pulmonary tuberculosis.....	8	2.43	Fever (origin undetermined).....	1	.30
Amebiasis.....	6	1.84	Atelectasis.....	1	.30
Hookworm disease.....	4	1.20	Malaria.....	1	.30
Giardia lamblia infestation.....	4	1.20	Gastro-enteritis, acute.....	1	.30
Strongyloidiasis.....	3	.91	Wounds, lacerated, multiple.....	1	.30
Pneumonia.....	2	.61	Abscess, dento-alveolar.....	1	.30

REMARKS

The results of a medical survey of 325 American and Canadian men following their liberation from Japanese prison camps are reported. The nature of the medical processing of these repatriates was, of necessity, rapid and incomplete. In some instances the accuracy of histories may be open to question. For the most part, patients relayed information given to them by Japanese doctors, or by American doctors or corpsmen interned in the prisoner's particular camp. In the matter of examination, certain desirable diagnostic laboratory procedures were not available to complete the clinical studies.

This survey does not attempt to present the medical status in general of Allied prisoners released from Japanese prisons. The men included in this study represent the more physically fit of the liberated prisoners, and of course it considers neither those internees who died in prison, nor those prisoners who were seriously ill and required immediate medical care before their evacuation to any distant hospital.

It should be emphasized that many of the dietary deficiencies noted resulted probably as much from the Occidental's inability to adjust to the normally low-protein, low-caloric Oriental diet as from any deliberate dietary maltreatment. It is to be regretted that more accurate means were not available for the evaluation of the etiologic role in the development of disease of the physical, mental, and dietary privations to which these men were subjected.



THE RADIOACTIVITY OF POTASSIUM AND ITS INFLUENCE IN KARYOKINESIS

"It has been observed that the K/Ca ratio in cancerous tissue increases with the degree of malignancy of the tumor. This has led to the hypothesis that the natural radioactivity of K is a factor in the development of cancer from abnormal karyokinesis. New measurements of the radioactivity of K^{40} are described from which it is found that its approximate period is 10 years, and its radioactive const. 10^{-10} per year. This means that each cell of a normal human body of 60,000 cc. volume would, on the average, be exposed to the radiations of 0.5×10^{-7} atoms of K^{40} . In a malignant tumor where the concentration of K is 5 times that in healthy tissue there would be one radioactive K^{40} atom for each million cells, yielding one ion per year for each cell. This is of the same order as that produced by cosmic rays, and is considerably below the tolerated and erythematous dosages admissible for manipulators of x-rays and radioactive products."—NAHMIA, MAURICE E. (Lab. Radiobiologie, Marseilles): Cahiers phys. 17: 27-39 (1943). Chemical Abstracts 40: No. 10, p. 2891, May 20, 1946.

THE DETERMINATION AND TREATMENT OF PENICILLIN-RESISTANT GONOR- RHEAL URETHRITIS

Report of Twenty-Four Cases

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Lieutenant Commander (MC) U. S. N.

Following the report of Herrell, Cook, and Thompson (1) on the successful treatment of five cases of sulfonamide-resistant gonorrheal infections by continuous intravenous drip in 1943, penicillin was immediately accepted as the panacea for this problem.

Shortly thereafter, Mahoney (2) and his associates published a clinical study of 753 patients, the object of which was to determine the proper and minimum dosage to obtain the necessary cure. They had 10 failures on a dosage of 120,000 units given at the rate of 20,000 units every 3 hours intramuscularly for 6 doses. Of these, 4 responded to a combination of chemotherapy and fever therapy (that is, 6 grams of sulfathiazole followed by fever therapy, with a temperature of 106° F. for 6 hours). The sulfathiazole was given in doses of 1 gram every 4 hours for 6 doses, and then within 2 hours fever therapy was employed. Five patients responded after a second course of penicillin (120,000 units) and one patient required a third course (175,000) at 25,000 units every 3 hours.

Atcheson (3) treated three groups of patients with a dosage of 75,000 units to 100,000 units of penicillin, with the following results:

1. 20.6 percent failures, using a total dosage of 75,000 units (15,000 every 3 hours)
2. 12.4 percent failures on retreatment with 100,000 units (20,000 units every 3 hours)
3. 9.7 percent failures, using 100,000 units total dosage (20,000 every 3 hours).

There were no failures on retreatment of this group with the same time dosage schedule. A third group gave 38.6 percent failures on a dosage of 50,000 units (10,000 every 3 hours). Retreatment of the

failures in this group with the same time dosage schedule gave 55 percent failures and retreatment of these failures with a dosage of 200,000 units (20,000 units every 3 hours) left four cases of 33.3 percent failures which were considered penicillin-resistant.

Oard (4) and his associates at the U. S. Naval Training Center, Bainbridge, Md., felt that in their series of 411 cases of gonococcus urethritis they obtained the best results with a combination of moderate doses of sulfathiazole (12 grams) and small doses of penicillin (50,000 units). In this combination these drugs appeared to enhance the effect of each other against the organism, and they suggested that the use of moderate amounts of sulfa and penicillin is a safe, rapid, effective, and economical method of treating gonococcus urethritis.

Josey and Kirshman (5) treated 500 consecutive sulfa-resistant cases of gonorrhea with 50,000 units of penicillin intramuscularly, 438 or 87.6 percent of which became asymptomatic, culturally negative and presumably cured. Of the 62 cases of therapeutic failures, 45 were apparently cured after an additional course of 100,000 units, making a total of 96.6 percent satisfactory results.

Other authors have reported comparable results (6) (7). However, it has become more and more apparent that the treatment of gonorrheal urethritis is not simply a matter of administering a prescribed dosage of penicillin. Saunders and May (8) treated 212 consecutive cases of sulfonamide-resistant gonorrhea in the male with intramuscular injections of penicillin. Seventeen cases, or 8 percent were not benefited although each received 3 courses, the total treatment in each case varying between 350,000 and 1,050,000 units. Sensitivity tests in vitro could not be carried out. The authors could not explain the high percent of failures.

The associated hazard of masking a concurrent syphilitic infection with the minimal dosage used in the treatment of gonorrhea must always be borne in mind (9). It is therefore of the utmost importance that these patients be reexamined at regular intervals and have the benefit of a monthly blood serology for 3 to 6 months. Such a statement is included in the health records of all patients who are treated in this hospital with penicillin for gonorrhea.

The detection of sulfa-resistant strains of *Neisseria gonorrhoeae* has been determined. Goodale (10) and his associates showed correlation between their technic for detecting sulfathiazole-resistance of strains of the gonococcus in vitro and clinical response of patients being treated with various sulfonamide drugs. Of 58 patients so studied 22 or 38 percent were found to be resistant to oral treatment with sulfonamides and in vitro tests, and were so proved by clinical response. Clinical results were correctly anticipated in approximately 98 percent of their cases. Landy and Gerstung (11) concluded that

in their series of 237 cultures of *Neisseria gonorrhoeae*, with few exceptions, individuals promptly cured of gonorrhea by sulfonamide therapy yielded sulfonamide-sensitive gonococcus cultures with low PAB (p-aminobenzoic acid) synthesis, while clinically resistant individuals yielded sulfonamide-resistant cultures with relatively high PAB synthesis. The authors believed that factors within the gonococcus may determine sulfonamide resistance to a greater extent than constitutional factors within the host.

The problem of the penicillin-resistant case is now receiving thorough study by interested workers. Cohn and Seijo (12) reported that a concentration of 0.008 units of penicillin per milliliter of medium was bactericidal for 45.5 percent of 82 sulfonamide-resistant and nonresistant strains of gonococcus and that none of the strains would grow in 0.16 units per milliliter of medium. More recently Bahn (13) and her associates were able to make 5 strains of gonococcus resistant to penicillin in vitro in concentrations 8, 64, 128, 200, and 400 times greater than the initial concentration permitting growth. Morphological changes of the gonococcus and a delayed fermentation of glucose were observed in the strains during the development of resistance to the drug. Our experience corroborates this, and we have also noted a change in staining characteristics (gram-positive).

As a guide in treatment and in order to detect penicillin-resistant organisms the authors inaugurated routine determination of penicillin resistance. The following three methods can be used for this determination:

I. "Gutter strip" plate method

Basic medium: Proteose peptone No. 3 agar with 2 percent dried hemoglobin.

Culture technique: Incubation under CO₂ tension (candle jar technic for 24 hours).

Indicator for oxydase reaction: 0.5 percent aqueous solution p-aminodimethylaniline monohydrochloride. (Eastman)

Technique: A half inch strip of agar is cut aseptically from a poured plate of basic medium. Similar melted medium, to which has been added measured amounts of penicillin dilution, is added to the gutter. When solidified, the plates are streaked at right angles to the gutter strip with the test culture and incubated for 24 hours under CO₂ tension.

Growth occurs on either side of the strip, but is inhibited over the strip in sensitive cultures (fig. 1). The degree of resistance is determined by the amount of growth centrally in relation to the known amount of penicillin in the strip (fig. 2). Growth is checked by oxydase reaction and stained smear.

II. Poured plate method

To 20 cc. portions of the melted basic medium, measured amounts of a penicillin dilution (1:5,000) giving a final range of 1 unit to 100

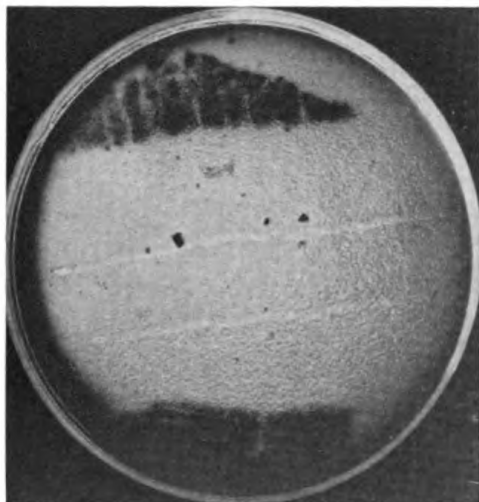


FIGURE 1.—“Gutter strip” plate showing inhibition of growth in media containing 5 units of penicillin per cubic centimeter.

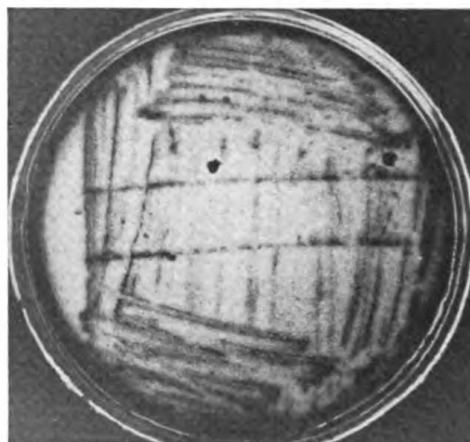


FIGURE 2.—“Gutter strip” plate showing moderate growth in media containing 5 units of penicillin per cubic centimeter.

units per cc. are added, plates poured, solidified quickly and streaked with the test culture. After 24 hours' incubation under CO_2 tension, the plates are flooded with indicator and growth checked by stained smear.

III. Broth titration method

To 5 cc. portions of proteose peptone No. 3 broth, penicillin is added in measured amounts to give a range from 1 to 50 units per cc. As a control, broth without penicillin is used. The media is incubated overnight under CO_2 tension and growth transferred to solid basic medium to check the growth and oxydase reaction.

If the organism shows resistance to growth on media containing 5 units of penicillin per cc. it is subcultured on plates containing 10, 20, 30, 40, and 50 units of penicillin per cc. With the knowledge that we are dealing with a resistant organism treatment can be modified promptly, rather than giving repeated courses of penicillin which may enhance the resistance.

A study of 24 cases of gonorrheal urethritis, all of which revealed varying degrees of resistance to penicillin in vitro was conducted. Ten of these were classified as initial infections, eight as relapses, and six cases as reinfections.

Of the cases of initial infection, the following is an example:

O. B., StM1c, was admitted to the sick list on 17 August 1945 complaining of a urethral discharge of 5 days' duration. He stated that the only exposure during the past month was to a pick up on 1 August 1945. He denied any previous venereal disease. The physical examination was essentially negative except for a profuse mucopurulent urethral discharge, containing gram-negative intracellular diplococci morphologically resembling *Neisseria gonorrhoeae*. Bacteri-

Table No I				Historical and Laboratory Data on Cases with Initial Infections
No.	Initial Rate	Date of Exposure	Onset of Symptoms	Laboratory
5	J.E.C. 5 1/2	6-15-45	6-17-45	7-10-45 Smear, Culture, Oxydase Positive 7-10-45 Resistance to 20 u Penicillin per/cc 7-20-45 Smears, Culture neg.
9	H.D.B. 7/567	7-8-45	7-18-45	7-20-45 Smear, Culture, Oxydase Positive Growth in 5u Penicillin per/cc 7-25-45 No Growth in 5u Penicillin per/cc 7-28-45 Culture, Smear neg.
12	D.P.F. 80M 1/2	7-14-45	7-20-45	7-22-45 Smear Positive 7-24-45 Growth in 5u Penicillin per/cc 8-1-45 Smears, Culture neg.
13	W.S.P. 5 1/2	7-18-45	7-21-45	7-22-45 Smear Positive 7-24-45 Growth in 5u Penicillin per/cc 7-28-45 Culture Positive 8-1-45 No Resistance to 5u Penicillin per/cc 8-9-45 Oxydase, Culture neg.
15	H.G.B. GM 1/2	10-21-45	10-25-45	10-26-45 Smear Positive 10-27-45 Growth in 5u Penicillin per/cc 11-2-45 Oxydase, Culture neg.
17	W.K.M. 5 1/2	7-15-45	7-25-45	7-27-45 Smear Positive 7-28-45 Growth in 5u Penicillin per/cc 8-4-45 Culture neg. 8-5-45 Smears (3) neg.
18	R.A.M. F 1/2	7-15-45	7-25-45	7-28-45 Smear Positive 7-30-45 Growth in 5u Penicillin per/cc 8-3-45 Cultures (2) neg. 8-7-45 Smear, Cultures (2) neg.
19	J.G. CCM	7-22-45 and 7-24-45	8-2-45	8-3-45 Smear Positive, Growth in 5u Penicillin per/cc 8-10-45 Culture Positive, Growth in 5u Penicillin per/cc 8-15-45 Culture, Smears (3) neg.
22	O.B. STM 1/2	8-1-45	8-12-45	8-17-45 Smear positive, Growth in 5u. Penicillin per/cc 8-22-45 Culture Positive, no Growth in 5u Penicillin per/cc 8-26-45 Culture, Oxydase, Smears (3) neg.
24	T.W.P. GM 1/2	7-30-45	8-6-45	8-11-45 Smear Positive, Growth in 5u. Penicillin per/cc 8-20-45 Culture, Oxydase Positive, No Growth in 5u Penicillin per/cc 8-20-45 Smears (3) neg.

ological analysis revealed the strain of gonococcus to be mildly resistant to penicillin. (Scanty growth in 5 units of penicillin per cc. of media.)

Because of this penicillin resistance, sulfadiazine, 15 grains, with soda bicarbonate, 10 grains, 4 times daily was instituted. Five days later the only complaint was a scanty mucoid "tear," examination of which revealed numerous white blood cells with an occasional extracellular diplococcus. A prostatic smear revealed 150 to 175 white blood cells per highpower field but no diplococci were seen.

Culture of the prostatic secretion was positive for *Neisseria gonorrhoeae*. Bacteriological analysis revealed the organism to have lost its resistance to penicillin after 4 days' treatment with oral sulfadiazine for a total dosage of 16 grams, and treatment was concluded with penicillin sodium in doses of 20,000 units intramuscularly every 2 hours for 10 doses with complete cessation of symptoms. The prostate was normal to palpation and the prostatic secretion was bacteriologically negative for *Neisseria gonorrhoeae*. He was returned to duty with the standard notation entered in his health record, "this man is to have a monthly blood Kahn for the next 3 months and a prostatic culture for gonococcus 2 to 6 weeks from this date."

A critical review of table 1 reveals that the average time elapsed between exposure and onset of symptoms was 7.2 days, the longest being

11 days (case No. 22) and the shortest being 2 days (case No. 5). All cases demonstrated resistance to penicillin by the gutter strip technique, one case (No. 5) being resistant to 20 units of penicillin per cc. of media. The initial urethral smears were positive for *Neisseria gonorrhoeae* in all cases and all initial cultures were reported positive. Five cases were rechecked at a later date for penicillin resistance. Four had lost their resistance, the average time elapsing since the initial determination being 6.5 days, the longest being 9 days (case No. 24) and the shortest being 5 days (cases No. 9 and 22). One case (No. 19) revealed a continued penicillin resistance after 7 days of treatment during which time he received 150,000 units of penicillin and 16 grams of sulfadiazine. Cultures and smears were negative on all patients prior to discharge from the hospital.

Therapy in this group of 10 cases was modified slightly so that 7 cases received a preliminary course of sulfadiazine, 16 to 24 grams, followed by penicillin, 150,000 to 200,000 units. Three cases received a preliminary course of penicillin, 150,000 to 200,000 units, followed by sulfadiazine, 24 grams, and concluded with penicillin, 200,000 units. Of the 5 rechecked cases, 3 were treated by sulfa followed by penicillin,

Table No. II				
Historical and Laboratory Data on Cases with Reinfections				
No.	Initials Rate	Past Venereal History	Date of Exposure	Laboratory
10	A. L. T. Cox	Gonorrhea 1-10-45 Chancroid 5-8-45	7-10-45	7-20-45 Smear Positive, Growth in 5u. Penicillin per/cc 7-28-45 Culture Positive No Growth in 5u Penicillin per/cc 7-31-45 Smears (2) Culture neg. 8-1-45 Smears (2) neg.
14	C. L. T. 5 1/2	Gonorrhea in Dec. 1944 and June '45	7-7-45 7-10-45	7-22-45 Smear Positive, Growth in 5u. Penicillin per/cc 7-28-45 Culture Positive. No Growth in 5u Penicillin per/cc 8-1-45 Oxydase neg. 8-2-45 Smears. (3) neg.
16	W. J. R. STM 1/2	Syphilis in March 1943 Treated with Bismuth and Mapharsen. Gonorrhea, 2-15-45 Treated with Penicillin 100,000 u.	7-19-45	8-1-45 Kahn, Kline, Wasserman Positive 8-14-45 Smear, Culture, Oxydase Positive on Gonorrhea 8-15-45 Resistance to all dilutions Penicillin. 8-20-45 No Resistance to Penicillin 9-11-45 Smear, Cultures (2) neg.
20	J. M. St 3/4	Gonorrhea in Feb. 1945	8-1-45	8-6-45 Smear Positive, Growth in 5u. Penicillin per/cc 8-13-45 Smear Positive, Growth in 5u. Penicillin per/cc 8-16-45 Culture, Oxydase neg. 8-18-45 Smears (2) neg.
21	C. L. S. F 1/2	Gonorrhea in July 1945	7-7-45	8-10-45 Smear, Culture Positive Growth in 5u. Penicillin per/cc 8-17-45 Cultures (2) Smears (2) neg. 8-21-45 Prostatic Culture neg.
23	W. A. R. SPIA) 3/4	Gonorrhea in May 1944	8-15-45	8-27-45 Smear Positive, Growth in 5u. Penicillin per/cc 9-1-45 Culture, Oxydase neg. 9-4-45 Culture, Oxydase neg.

and 2 were treated by penicillin followed by sulfa and concluded with penicillin. Of the 4 which were demonstrated to have lost their resistance to penicillin, 3 responded to a preliminary course of sulfadiazine followed by penicillin, while 1 received penicillin followed by sulfa and concluded with penicillin. It would seem therefore that a combination of sulfadiazine and penicillin is more efficient therapeutically than either drug alone.

Of the cases of reinfection, the following is an example:

C. L. T., S1c, was admitted to the sick list on 22 July 1945 complaining of a urethral discharge of 8 days' duration. He stated that he was exposed on 7 July 1945 and again on 10 July 1945. His past history revealed gonorrhea in December 1944 and June 1945. Physical examination was essentially negative except for a profuse mucopurulent urethral discharge. Laboratory studies of the urethral discharge revealed many white blood cells and many gram-negative intra- and extra-cellular diplococci morphologically resembling *Neisseria gonorrhoeae*. Bacteriological analysis revealed mild resistance to penicillin.

Because of this penicillin resistance, sulfadiazine, 15 grains, with soda bicarbonate, 10 grains, 4 times daily was instituted with the dosage reduced one-half after 4 days. At the end of this time a prostatic culture remained positive for *Neisseria gonorrhoeae* but the organisms had lost their resistance to weak dilutions of penicillin (no growth on culture to which 5 units of penicillin per cc. of media had been added). Three days later penicillin was administered in doses of 20,000 units intramuscularly every 2 hours for 10 doses with complete cessation of symptoms. Sulfadiazine was discontinued, a total of 12 grams having been given. At the conclusion of treatment prostatic smears were negative for white blood cells and diplococci. The patient was returned to duty with the standard notation entered in his health record.

The average time lapse between exposure and onset of symptoms in five of the six cases of reinfection was 6.4 days, the longest being 8 days (case No. 21) and the shortest being 4 days (case No. 20). In the sixth (case No. 16) 26 days elapsed between exposure and the onset of symptoms. This case was unusual in that the urethral discharge began less than 4 days after the patient had received 2,400,000 units of penicillin for syphilis. All cases revealed resistance to penicillin as demonstrated by culture, 1 (case No. 16) being resistant to all dilutions, the highest of which was 50 units of penicillin per cc. of media. Four cases were later rechecked for penicillin resistance. Three had lost their resistance, the average time elapsing since the initial determination being 6.3 days, the longest being 5 days (case No. 16). One patient (case No. 20) revealed a continued penicillin resistance after 7 days of treatment during which time he received 20 grams of sulfadiazine. Cultures, oxydase reactions and/or smears were negative for *Neisseria gonorrhoeae* prior to discharge from the hospital.

In this group of six cases the treatment was varied so that four received sulfa followed by penicillin, one received penicillin followed by sulfa and concluded with penicillin, while one was placed on concurrent sulfa and penicillin, 350,000 units. Of the four cases rechecked

for penicillin resistance, three received sulfa followed by penicillin and one received penicillin followed by sulfa and concluded with penicillin. All except one showed a loss of resistance to penicillin following the administration of sulfadiazine. However, it is worthy of note that in this group, in one case clinical signs and symptoms of gonorrhea developed while the patient was under penicillin therapy, and in another 20 grams of sulfadiazine was required to bring about a cure.

Table No. III Historical and Laboratory Data on Cases with Relapses			
No.	Initial Date	Past Venereal History	Laboratory
1	R.H.D. Mammæ	Treated for Gonorrhea 5-20-45 with 100,000 u. Penicillin + Discharged to Duty. Recurrence 7-1-45	7-12-45 Smear Positive 7-17-45 Culture, Oxydase Positive 7-18-45 Growth in 5 u. Penicillin per/cc 7-23-45 Smear Positive 7-23-45 Culture neg. 7-25-45 Culture neg.
2	C.R.T. S 1/2	Treated for Gonorrhea 4-20-45 with 100,000 u. Penicillin with relapse on 5-1-45, 6-16-45, 7-2-45 and 7-6-45	7-19-45 Smear neg. 7-16-45 Culture, Oxydase Positive 7-20-45 Culture Positive, Growth in 5 u. Penicillin per/cc 7-26-45 Culture, Oxydase neg.
3	G.C. B.M. 1/2	Treated for Gonorrhea 5-26-45 with 100,000 u. Penicillin, Relapse, 6-2-45 and treated with 500,000 u. Penicillin.	6-26-45 Culture, Oxydase Positive Swollen Pleomorphic cells. Growth in 50 u. Penicillin per/cc 7-6-45 Cultures Repeatedly Positive until 8-6-45 9-4-45 Successive Cultures neg.
4	R.E.C. B 1/2	Treated for Gonorrhea on 6-1-45 with 100,000 u. Penicillin.	7-7-45 Smear, Culture, Oxydase Positive Growth in 40 u. Penicillin per/cc Organisms 2-3 times normal size and Gram Positive 7-12-45 Smear, Culture, Oxydase neg.
5	M.W.R. S.M. 1/2	Treated for Gonorrhea 4-6-45 with Penicillin 100,000 u. and Sulfathiazole 270 gr. 4-19-45 Penicillin 75,000 u. 5-31-45 " 100,000 u. 6-1-45 " 500,000 u.	7-7-45 Smear, Culture, Oxydase Positive Growth in 50 u. Penicillin per/cc 7-11-45 Culture Positive. Growth in 10 u. Penicillin per/cc 7-15-45 Cultures, Smears neg. 7-24-45 4 consecutive Smears neg.
7	M.W.C. S.M. 1/2	Treated for Gonorrhea 6-9-45 with Penicillin 100,000 u. 7-2-45 relapse Penicillin 150,000 u.	7-18-45 Smear, Culture Positive 7-21-45 Culture Positive, Growth in 5 u. Penicillin per/cc 7-25-45 Culture Questionable 7-26-45 Smears (2) neg.
8	J.R.K. S 1/2	Treated for Gonorrhea May 1945 with Penicillin 100,000 u. 8th similar course. Totalling 700,000 u. Last course on 6-29-45	7-18-45 Smear, Culture Positive, No resistance to Penicillin 7-26-45 Repeated Growths show no resistance to Penicillin 8-4-45 Culture Remains Positive 8-8-45 Smears (3) Culture neg.
11	A.M. A.E.R.M. 1/2	Treated for Gonorrhea 7-7-45 with Penicillin 100,000 u.	7-21-45 Smear, Culture Positive 7-24-45 Growth in 5 u. Penicillin per/cc 7-26-45 Smear, Culture neg. 8-2-45 Smears (3) neg.

Of the cases of relapse, the following is an example:

R. L. C., S2c, was admitted to the sick list on 5 July 1945 complaining of a urethral discharge of 10 days' duration. He denied sexual exposure since he was discharged from this hospital on 2 June 1945, having been treated with 100,000 units of penicillin for gonococcus infection of the urethra. Physical examination was essentially negative except for a profuse mucopurulent urethral discharge. Laboratory studies of the urethral discharge revealed many gram-negative intracellular diplococci morphologically resembling *Neisseria gonorrhoeae*. Cultures and oxydase tests were positive, and a growth was obtained on media containing

40 units of penicillin per cc. Many colonies contained organisms two to three times the usual size and many were gram-positive, a morphologic and cultural characteristic seen in previously treated cases.

Because of this marked penicillin resistance, sulfadiazine, 15 grains, with soda bicarbonate, 10 grains, four times daily was instituted to a total of 225 grains followed by penicillin in doses of 25,000 units intramuscularly every 3 hours to a total of 600,000 units. Five days later the prostate was normal to palpation and the culture of prostatic secretions was negative. The patient remained asymptomatic and culturally negative for 3 weeks at the end of which time he was returned to duty with the standard notation entered in his health record.

The average time interval between the last treatment and the present relapse was 13.1 days, the longest being 23 days (case No. 4) and the shortest being 4 days (case No. 2). All denied sexual exposure in the interim except case No. 7, but because this patient's urethral discharge reappeared within 24 hours after exposure and because he had received treatment for gonorrhea during the previous 2 weeks, he was considered a relapse and not a reinfection.

The previous number of relapses ranged from one to six, the most being in case No. 8 who received seven successive courses of penicillin with temporary improvement after each course. Laboratory studies in this group were interesting. Seven of the eight cases revealed penicillin resistance ranging from 5 units per cc. of media (cases 1, 2, 7, and 11) to 40 units per cc. of media (case No. 4) and 50 units per cc. of media, which was the highest determination measured (cases No. 3 and 6). The maximum resistance could be anticipated in cases No. 3 and 6 since both had received as previous medication 600,000 units of penicillin and 775,000 units respectively, but the complete lack of resistance of case No. 8 who had received previously 700,000 units could not be explained. Three successive examinations failed to reveal any resistance. On recheck of case No. 6 four days after the initial examination, growth was inhibited by 10 units of penicillin per cc. of media. In two instances (cases No. 3 and 4) examination of the organisms revealed swollen pleomorphic cells and in case No. 4 the organisms were gram-positive. This morphological change has been previously reported (13). Prior to discharge from the hospital smears were negative on all patients and all cultures were negative except in the case of No. 7 which was reported questionable.

TREATMENT

As all cases of relapse had previously received penicillin in dosages varying from 100,000 units to 775,000 units, the initial treatment of this group consisted of sulfathiazole or sulfadiazine. This group, being the most resistant to penicillin as proved by the numerous clinical and bacteriological relapses, was maintained on the initial treatment of sulfa for from 2 to 19 days, depending both on clinical response and laboratory studies of changing penicillin resistance.

As a general rule all cases of initial infections were begun on sulfathiazole or sulfadiazine and later treated with penicillin. Three cases were initially treated with penicillin but when penicillin-resistance was detected, all were changed to sulfadiazine for 8 days before resuming penicillin.

Of the six cases of reinfection three were treated initially for 8 days with sulfadiazine during which time the penicillin sensitivity was determined. These three cases were then treated with penicillin which resulted in a prompt cessation of symptoms. One case was initially begun on penicillin but when the penicillin resistance was determined, sulfadiazine, 4 grams daily for 12 days, was instituted before penicillin treatment was again resumed. In case No. 16, in which clinical manifestations of gonorrhea developed following 2,400,000 units of penicillin, sulfadiazine was instituted in doses of 4 grams daily for 25 days before penicillin was again used. During that time further study revealed the organism to have lost its resistance to penicillin. In only one case (No. 23) were the two drugs combined, which resulted in an apparent prompt cure.

TABLE 4

Case No.	Treatment					
	Sulfathiazole	Sulfadiazine	Penicillin	Sulfathiazole	Sulfadiazine	Penicillin
	Grams	Grams	Units	Grams	Grams	Units
1.....	24		200,000			
2.....		32	200,000		60	500,000
3.....	8		150,000			
4.....	225		600,000			
5.....		16	200,000			
6.....	96		400,000			
7.....		24	200,000			
8.....		24	200,000			
9.....		16	150,000			
10.....			150,000		12	200,000
11.....		24	200,000			
12.....		24	200,000			
13.....			200,000		24	200,000
14.....		24	200,000			
15.....		16	200,000			
16.....			2,400,000		100	500,000
17.....		24	180,000			
18.....			150,000		24	200,000
19.....			150,000		24	200,000
20.....		24	200,000			
21.....		24	200,000			
22.....		16	200,000			
23.....			350,000			
24.....		24	200,000			

¹ Combined with 12 grams of sulfadiazine.

SUMMARY AND CONCLUSIONS

Herewith is presented a study of 24 cases of gonorrheal urethritis with particular reference to resistance to penicillin. This study includes cases of initial infection, reinfection, and relapse. While there is ample literature in regard to the successful treatment of sulfa-

resistant gonococcus infections with penicillin, references in regard to the treatment of the not infrequent cases in which penicillin has failed are totally lacking. In addition to the potency of the penicillin as a factor accounting for the failures, there are probably others as yet undetermined, perhaps related to the individual, the type of infection, or the particular strain of the gonococcus in each individual case. In order to overcome one of the possible factors involved, namely resistance of the organism to the drug, we have introduced the gutter-strip plate method of detecting penicillin resistance in every case under study, and a modification of therapy depending upon the degree of sensitivity of the organism.

From our observation it would seem that failure of results with either penicillin or one of the sulfa drugs calls for a determination of sensitivity to the drug and modification of therapy in accordance with the findings. There seems to be little correlation of resistance in the individual infected for the first time, or in the individual who has suffered multiple infections or relapses. This may be explained by the fact that in any individual case exposure may have been to an organism previously insulted by either one of the drugs, and thereby made resistant to that drug. It is worthy of note, however, that in all cases resistance can be broken down by changing to the drug to which the organism reveals a sensitivity, regardless of whether this be penicillin or one of the sulfa drugs. It is also to be noted that nothing can be gained by persisting in the use of a drug, either in repeated courses or in increased dosage, once resistance to the drug has been determined. That there is a tendency for repeated, inadequate therapy to enhance the resistance of the organism is clearly demonstrated in the cases which relapsed. Inadequate therapy probably also accounts for the change in morphology and staining characteristics of the organism. This study would seem to indicate that the procedure of choice in the therapy of uncomplicated gonorrheal urethritis is a course of sulfadiazine followed by penicillin. A further refinement in therapy will be the eventual determination of the particular strain or compound of penicillin that is specific for the gonococcus.

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THE RELATIONSHIP BETWEEN MEASLES AND TUBERCULOSIS

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This report is submitted primarily to show the rapid onset of tuberculosis following measles. Also, to stress the need for careful examination of all patients having prolonged recuperative periods. Repeated x-ray studies with concurrent sputum examinations are therefore indicated. Lastly, a consideration of the immune factors and pathological lesions associated in the production of this relationship is presented.

CASE REPORT

An 18-year-old apprentice seaman was admitted to the contagious ward with scarlet fever on 12 May 1945. Eight days later the diagnosis was changed from scarlet fever to measles by reason of intercurrent disease. The patient was retained on the ward longer than usual because of failure to show satisfactory

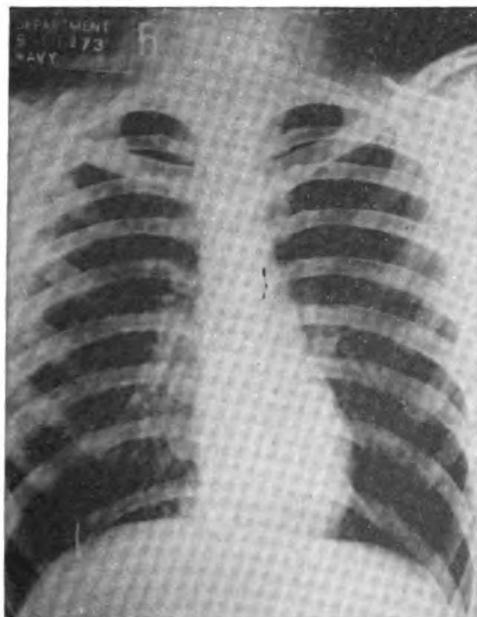


FIGURE 1.

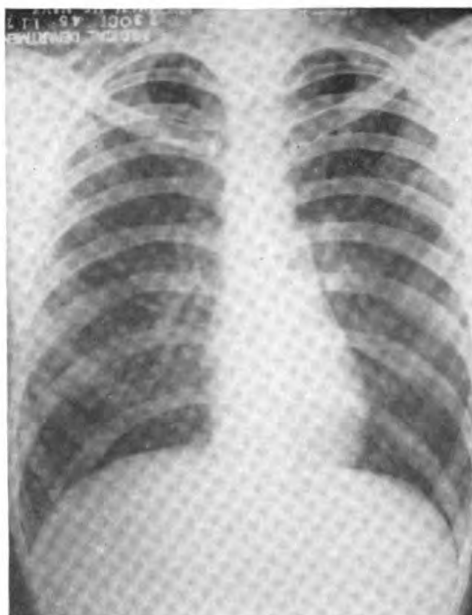


FIGURE 2.

recovery. The individual was considerably underweight and his condition appeared to be very unsatisfactory. However, an x-ray examination of the chest was negative on 19 June 1945 (fig. 1).

On 28 June 1945 the patient was sent to a rehabilitation unit for 4 weeks convalescence. On 23 August 1945 the patient was returned to the hospital with little, if any, change in health noted. He still complained of symptoms of upper respiratory infection, palpitation, shortness of breath, and still was underweight. Physical examination was otherwise negative at that time. He was again sent back to the rehabilitation unit for additional convalescence.

The patient was returned to the hospital on 23 October 1945 having anorexia and considerable coughing with expectoration. Chest pathology, as noted in a chest film on that date, was suspected, and active pulmonary tuberculosis was soon proved (fig. 2). Acid-fast bacilli were found in five daily sputum examinations. A change of diagnosis was duly made from Measles to Tuberculosis, Pulmonary, Re-infection, Active, Moderately Advanced by reason of Complication. Familial and contact history were negative.

The accompanying chest films, taken on dates just 4 months and 4 days apart, illustrate the earlier negative film (fig. 1), and the later one with pathology in the upper left chest, proved to be a moderately advanced stage of tuberculosis (fig. 2). It is noted that the second film shows on the left, overlying the shadow of the fifth posterior interspace, a circumscribed area of increased density with a radio-lucent center 1 cm. in diameter. Lateral to this is an area of increased density about 15 by 25 mm. with increased lines leading to the left hilar region.

Costantino (1) and Holt and Howland (2) say that an attack of measles in a child should always be looked upon with apprehension. Meakins (3) states that the association of measles with tuberculosis is almost unique and more than coincidence. The type of tuberculous lesion developing after measles can be either a generalized miliary tuberculosis or a lobular pneumonic phthisis. The onset of tuberculosis infection can either be during the course of measles, gradually dominating the picture, or there may be a latent period of many weeks or months of fair health before its appearance. In rare instances, it may appear in the form of a tuberculous meningitis.

Lucke (4) in a discussion of postmortem findings of measles, states that a true bronchopneumonia caused by the measles virus does exist. The classical lesion of this type of pneumonia is characterized by megakaryocyte-like masses with 8 to 15, or more, nuclei described originally by Alagna (*Milles* (5)). Lucke (4) originally described the appearance of a measles bronchopneumonia from postmortem section of the lung as consisting of rounded, grayish red and raised, small, firm, shotty nodules, resembling miliary tubercles. These usually surrounded a small bronchiole from which thick pus could be expressed. Extension of these lesions into the peribronchial tissue and alveoli can give either discreet or confluent pneumonia. The pleura in a case of primary measles pneumonia remains smooth and

glistening, and does not develop a fibrinous exudate as seen in lobar and some types of bronchopneumonia. The multinucleated giant cell of Alagna may not be found except after sections of many layers of the involved tissue, but when found, it is a specific, diagnostic feature of a measles infection (5) (fig. 3). Lucke (4) redirects attention to the resemblance of the disseminated bronchiolitis-peribronchiolitis-bronchopneumonia of measles to miliary tuberculosis.

The interest of the authors was upheld in this study by these pathological and x-ray similarities plus the clinical case herein reported. Furthermore, the reports of other authors on clinical observations of the development of tuberculosis following measles substantiated this belief. Francine (6) reports an incidence of 3.11 percent of tuberculosis infections immediately following measles in a series of 513 cases studied. The division to which these men were attached had a tuberculous incidence of only 0.92 percent. Two-thirds of these cases had bilateral involvement. German measles was observed to have no affect upon increasing the incidence of tuberculosis.

The immune factors which are altered during the acute infection of measles are well known. They are especially given cognizance by authors of European medical literature (1) (8) (14) (15) (16). Meakins (3), Cecil (7), and Goebel (8) comment upon the alteration of the positive tuberculin reaction of the skin during the acute phase of measles. Goebel (8) states that the reaction usually stays negative until approximately 10 days after the appearance of the rash. In contrast, the same test becomes intensified during the pre-eruptive stage of the measles. The author also feels that measles contributes to the spread of a tuberculous process. Kohn and Koiransky (9) concur in these findings. Our own observations of a limited number of tuberculin skin tests agree in the main with these findings. Forty-one of forty-two Mantoux tests on measles cases during the immediate post-eruptive stage of the disease were negative. Goldstein (10) also concurs in these findings.

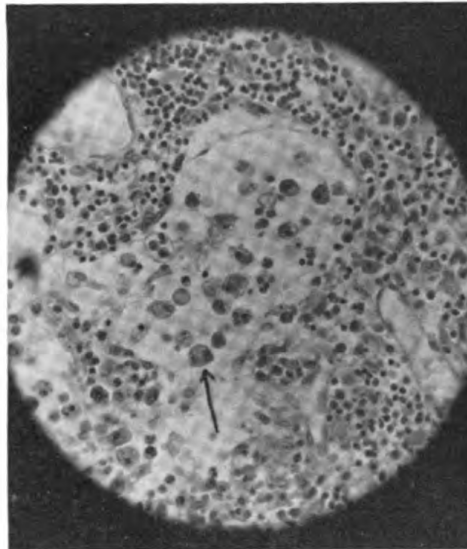


FIGURE 3.—Microscopic section of hilar lymphnode demonstrating the multinucleated giant cells of Alagna of the macrophage type with plasma cells which are seen lying within a dilated sinus.

These results are in contrast to an incidence of positive Mantoux tests of 23.7 percent in a total of 7,622 cases comprised of various groups and residing in many localities throughout the United States. These last figures are arrived at by combining the studies of Lumsden, Dearing, and Brown (11), Gleich (12), and Crimm (13).

Kohn and Koiransky (9) state that there is a return of positivity of the Mantoux test following in 8 to 20 days after measles. They furthermore found that in two instances in which this did not occur that old tuberculous lesions were present at later necropsies. These authors feel that measles hastens the spread of tuberculosis. The x-ray picture of measles bronchopneumonia can be said to be a changing picture from day to day while the tubercular lesion is more slow in its progress. This differential point in the roentgenological course of the two diseases is of prime importance. Especially is this true in the roentgenograms of measles pneumonia which exhibit a disseminating process not unlike that seen in miliary tuberculosis (5).

In conclusion, from these many interesting observations made by many authors but not often stressed by clinicians, the authors find a very potent and practical issue to be solved in the management of these common diseases. As the reader will note, the case here presented was entirely free of any evidence of either pneumonia or tuberculosis at the time of his release to convalescence. In the ensuing weeks, the reactivation of some small latent focus was proceeding rapidly enough to produce the clearly visible cavity seen on the film presented. The burden falls on the clinician then to properly follow all measles cases to detect the incipient onset of tuberculosis following the recovery from the acute illness. As noted, Francine (6) found this incidence to be almost four times as great as in others who had not recently had measles. It is suggested that chest films taken at 2- and 4-month intervals, post-measles, should be the routine practice following the illness. Such methods supplemented with indicated sputum studies will eradicate the untreated tuberculous lesion in this group of cases.

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A CONSIDERATION OF THE SIGNIFICANCE OF HALLUCINATIONS

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A hallucinatory experience presents an extremely difficult psychiatric problem, being distressing to the majority of patients and aggravatingly vague and elusive to the physician who seeks to explain the phenomenon to the patient or his relatives. Hallucinations are rather common in a variety of mental illnesses, being present in certain of the organic and toxic syndromes, as well as in many of the so-called "functional" diseases. Although helpful interpretations have been made of such symptoms, the exact reasons for their occurrence in some patients and not in others are not at all clear, and many varieties of hallucinations still seem meaningless whether considered as manifestations of disturbed cerebral physiology or of psychological conflicts. In spite of our ignorance those of us in psychiatry work daily with hallucinated patients and frequently must interpret these symptoms in an effort to help the patient accept and understand his illness. The problem is further complicated by the fact that "hearing voices" or "seeing visions" are commonly associated in the public mind with the dread word "insanity," with the result that the symptoms may be discussed by the patient only with great reluctance, if at all, shame and fear enforcing silence during and after the convalescent period.

In the *Psychiatric Dictionary*¹ a hallucination is defined as "a sense perception to which there is no external stimulus." Such perceptions—auditory, visual, olfactory, gustatory, tactile—seem real to the patient who seeks for their explanation in terms of his environment, being unable to understand or accept them as evidences of an illness. To the casual observer the experiences of the hallucinated patient may seem bizarre or absurd and their significance missed. In many cases the hallucination indicates psychological material that should be seriously investigated, and may serve as a helpful indicator directing attention to otherwise repressed emotional conflicts.

¹ HINSIE, L. E., and SHATZKY, J.: *Psychiatric Dictionary*. Oxford University Press, New York, N. Y., 1940.

It is of fundamental importance to recognize that hallucinatory states are found in many conditions other than the psychoses and apparently are related to phenomena that are physiological and part of our everyday experience. The fantasy of childhood and the day-dreaming of adult life may seem exceedingly realistic, although not normally substituted for reality. Such voluntary play of thought may serve a useful function, being the start of constructive planning as well as affording a pleasurable transient release from certain aspects of reality. Much good and no harm may come from well-controlled fantasy, although the tragedy of a mental illness awaits the individual who rejects reality for the slavery of the dream. Eidetic images—phenomena that are intermediate between the usual visual image and the after-image—are common in children and are occasionally found in adults. Although the explanation for this type of memory is not clear, the experience is a fairly common one and is not considered pathological. Hypnagogic images—those visions and sounds that may occur during the period between wakefulness and sleep—are frequently reported by individuals who are not mentally ill, yet their resemblance to hallucinations is striking. All of us occasionally dream and one has to spend but little time in contact with patients from combat areas to know that many dreams are startlingly real and present visions and sounds that are as disturbing to the patient as were the experiences which they reflect. The types of imagery mentioned here may be experienced by any so-called “normal” person, and in each instance there is absence of actual stimulation of the appropriate sensory end organ, the sensation itself may seem very real, and there is no adequate explanation in terms of physiology or pathology.

Hallucinations are common accompaniments of certain organic cerebral disturbances (11) (12) (19) (20) (21) (38). Irritation of any portion of the visual pathway, by tumor, vascular lesion, etc., may give rise to visual hallucinations. Lesions in the occipital region usually produce simple phenomena, such as flashes of light, more complex figures resulting from involvement of the temporal fibers. Crude sounds—buzzing, roaring, ringing—may arise from pathological changes in the temporal lobes, and olfactory-gustatory phenomena may result from dysfunction of the uncinate area. Lilliputian hallucinations (1) (3) (9) (23) (40) (42), more commonly associated with toxic states, are described as occasionally resulting from vascular lesions of the mesencephalon or tumors of the pituitary. Auditory, visual, or combined sensory *aurae* occur in some epileptic states, and scintillating, polychrome figures are not infrequently visualized in migraine. Both visual and auditory phenomena may be experienced in narcolepsy, these being most common as the patient

is awakening. Hallucinoses are a not uncommon accompaniment of the delirium of uremia and febrile states as well as alcoholism and toxicity produced by various drugs (42) (43). Visual, auditory, tactile, and Lilliputian hallucinations are common in the intoxication caused by bromides and *Cannabis indica*. Mescal is noted for its production of complex, colored visual patterns (26).

Hallucinations are occasionally present in cases of paresis and in chronic encephalitis, but are not common. A minority of arteriosclerotic and senile psychotics describe hallucinations. Such phenomena are very rare in the affective (manic-depressive) disorders, and usually absent in paranoid states. In the great majority of schizophrenics hallucinations are found at some time during the course of the illness (17) (18) (31) (37). Hallucinations also occur as accompaniments of disturbances of cerebral metabolism and the oxidation of glucose. The mental changes associated with nicotinic acid deficiency in pellagra are well known, and it is possible that our concepts of certain psychiatric symptoms may be considerably altered as our understanding of cerebral carbohydrate metabolism increases (43).

It is apparent from a brief review of the subject that hallucinatory phenomena occur in a wide variety of conditions and are by no means to be associated only with the lay concept of "insanity." In the majority of psychotic patients who describe hallucinations no organic or toxic explanation for the symptoms can be found. In many, however, an investigation of the hallucinations may be extremely helpful in gaining an understanding of the mechanisms of the illness and the emotional conflicts that may be contributory to the symptomatology. Many of those men diagnosed schizophrenia in the Navy are acutely ill and display a clinical picture that differs considerably from the more classical types of dementia praecox described in the older textbooks. In these cases situational factors are often more obviously prominent and we are able to witness more easily the unsuccessful struggle made by the individual to adjust to what is for him a difficult and demanding situation. The nature of the conflicts is frequently quite apparent, the factors of nostalgia, fear, sexual maladjustments, inability to accept authority, etc. playing important roles. Frequently the hallucinations found in such disorders seem to indicate clearly the underlying disturbances and thus may be helpful in investigating the illness and in assisting the patient to gain insight when that is considered desirable. There follows a series of cases briefly presented to illustrate the type of hallucination which seems so closely related to the emotional conflict and shows relatively little distortion. Such hallucinations seem to resemble dreams that picture an event that has occurred in the past or that the dreamer

hopes will occur in the future. In such dreams and hallucinations there is little distortion, condensation, or symbolism, and the subject matter apparently rather clearly reflects the thoughts and conflicts of the dreamer and patient.

CASE REPORTS

Case 1.—This is a S2c, U. S. N. R., 20 years of age, single, with 4 months and 12 days of active duty prior to his admission to the sick list. He has always been a quiet, seclusive individual, who avoided group activities and associated only with people who were considerably older than he. He left school in the eighth grade and worked as a farm laborer, but had never been away from home before entering the military service. He had great difficulty in adjusting to the training-camp routine, was very homesick, and thought of little else than his desire to go home. A blister developed on one foot, he became slightly lame, and soon thought that he should receive a medical discharge. As he proceeded with his training he seemed to hear the voices of officers talking about him and one voice quite clearly said: "This man should be given a medical discharge." His boot training completed, he went home on leave. His home is in a rural community and it was necessary for him to walk some distance from his house to the local bus depot. When he left his home to return to camp on the expiration of his leave he walked along the country road alone, low in spirits, dreading his return to the training station. Suddenly he seemed to hear his mother's voice say: "Come back. Your medical discharge is in the mailbox." The man immediately went back to the house and searched the mailbox, refusing to believe his mother when she insisted that she had not spoken to him and that no papers had come for him. A few days later he was admitted to the sick list, the diagnosis being schizophrenia, hebephrenic type, borderline mental defective. In this case the hallucinations apparently were a type of wish-fulfillment, the phantasy of going home finally assuming the characteristics of reality to the patient.

Case 2.—This is a S1c, U. S. N., 19 years of age, single, with 2 years, 4 months active duty. He comes from a small town in the Northwest where he was one of four children in a closely knit family group. He was well liked in his home community, finished the ninth grade of school and is of average intelligence. He entered the Navy at the age of 16 years, and served aboard a DE in the Mediterranean, where his ship was repeatedly attacked by enemy planes. He performed his duties satisfactorily and was given a leave when his ship returned to the United States for overhaul. His visit at home was pleasant, but he became very apprehensive while returning to his ship, being fearful that he might be killed by explosives placed aboard by enemy agents. He then began to hear the sounds of planes and machine guns, becoming so disturbed by these that he stuffed his ears with cotton and failed to join his ship, going to the home of relatives instead and finally reporting in AOL. He was tense, fearful, trembled violently, and said: "The planes keep me awake at night. They are German planes and are going to get me. If I only had a gun I'd get them." Although the diagnosis of dementia praecox was made, hysterical features were prominent. The case is of interest in that the patient's hallucinations were of a simple type (he never heard "voices") and seemed directly related to his traumatic experiences in the service. Improvement in the hospital was rapid and his hallucinations disappeared as he began to feel more secure.

Case 3.—This is a BM2c, U. S. N., 21 years of age, single, with nearly 4 years of active duty, a portion of which was spent in combat zones. He was finally

assigned to college in the V-12 program but was soon hospitalized because he developed ideas of reference, became confused, and was unable to carry on his work. The patient's father is a bitter, dogmatic, rigid, unyielding pastor of a small church. His first wife died 2 months after the birth of the patient, who was then cared for in a foster home. The father married a second time but his wife died a few months later. Again the father was married, this time to a stern, religious woman who rejected her stepson. Both father and stepmother were extremely critical of the patient, blaming him for his lack of religious zeal, reprimanding him for associating with girls, and finally dismissing him from the home. The patient has always felt bitter toward his father, but at the same time has felt guilty because of this bitterness—particularly in view of the fact that the father is admired and looked upon as a religious leader in the community. Although he hated the father because of the mistreatment and rejection experienced, he obviously felt a great need of receiving this parent's praise and love. The patient had often received a great deal of verbal abuse from the father, who had insisted that his son attend theological school and displayed episodes of rage when his son failed to accept such advice. During the acute phase of this man's illness he was preoccupied with religious ideas and determined to enter the ministry. Of his hallucinations he said: "I heard my father's voice. He was calling to me and it sounded like he was angry. I felt so guilty because I believed I had done wrong by not listening to him and taking his advice when he used to lecture me. The voice seemed to come out of the walls—he would shout at me—and I couldn't understand it." These hallucinations seem to reflect quite clearly the underlying conflict with little distortion. Another observation of this same patient is of some interest because of its bizarre quality. The meaning and relation to the same conflict between father and son seem apparent but there is greater distortion present. At one time during the patient's hospital stay some of the other men on the ward were throwing and catching a large leather-covered ball. When the ball was thrown to this patient he would either drop it as if the act of catching it were very painful, or he would turn away as if in great fear and make no effort to catch it. Later he explained his actions by saying: "For a time it seemed as if every move I made might hurt my father. I could not catch the ball because when it struck my hands I seemed to hear a scream. I had the idea that maybe I had killed my father—and his skin had been tanned and used to cover the ball. Then when I touched the ball I seemed to hear my father screaming in pain." In this instance the hallucinations and actions of the patient were meaningful and helpful in pointing the way to the conflicts that were so disturbing to him.

Case 4.—This is a S2c, U. S. N. R., 19 years of age, single, with about 8 months of active duty in training camps in the United States. He was sent to the sick list when he suddenly struck a guard without apparent provocation and became violently disturbed, maniacal, and destructive. During his illness, which persisted for several months, he spent much of his time in seclusion as he was actively homicidal, attacking anyone who approached him. He finally improved under electric shock treatment, making a good recovery, and returning to his home and later to college. He comes from a comfortable, closely knit home, where he was the idol of his parents and older sister, being the only son. He was very dependent upon his mother, who permitted him to assume no responsibility, and he had never been separated from his family prior to his entry into the Navy. He has been a passive, quiet boy, interested in music, but not noted for his aggressiveness. In the service he found it difficult to adjust to military life, and often doubted his ability to do his part in a combat situation. He was fearful that he

would fail should he be placed under stress, and would attend showings of combat training films only with great reluctance and dread. He began to suspect that others knew of his fear and soon believed that he was being talked about unfavorably. His assault on the guard was made because he believed that innocent individual had called him "yellow." During the acute stage of his illness he was tormented by "voices" that laughed at him, called him "yellow" and "coward," and challenged him to fight and prove that he was "a man." Although this illness can probably not be explained in such a facile manner, the hallucinations seem to point the way rather clearly to one of the major underlying conflicts.

Case 5.—This man is a S1c, U. S. N. R., 28 years of age, single, with about 2 years of active duty. He spent a prolonged period of time aboard ship in the South Atlantic area, having brief liberty ashore at infrequent intervals. He had no sexual relations with women while ashore, explaining this by a professed fear of contracting a venereal disease. Before entering the Navy he had worked since boyhood in his uncle's tavern, being promoted to bartender as he grew older. He had formed no permanent sexual attachments but was very fond of his aunt, in whom he confided and to whom he always turned for advice. He denied ever having had homosexual relations, but it is of interest that he was never married, had not had satisfactory sexual intercourse with a woman, and said that he actually felt little sexual desire. While in certain South American ports he was approached by homosexuals and became greatly disturbed as a result. Describing one such incident he said: "When I was on liberty I saw a couple of people who were that way. I hate people like that—they're no good. I can't stand to be near them. I tore down the door of the room where they were and I beat up one of them." When he came home on leave a woman of his acquaintance was very friendly and quite freely offered herself to him. He found himself repelled by her attitude, discovered that he had no sexual desire for her, and became fearful that she would think poorly of him and that others might criticize him for a lack of "manliness." Long before his leave was over he left his home to return to camp, believing that he would be happier aboard ship. On the train he became panic-stricken and experienced numerous bizarre hallucinations and delusions. Of this he said: "On the train I heard people call me a 'queer.' People offered me drinks—and I was afraid they might be poisoned. I seemed to smell a peculiar gas and then my testicles felt as if they were falling off. I drank some beer and it had a strange taste as if it had been doped. In the hospital I kept hearing a voice say 'You're a queer—you're a killer.'" The patient was tearful and overwhelmed by these experiences, saying: "I never did such things. I hate homosexuals. Why should they call *me* one?" This man had never made a satisfactory heterosexual adjustment but had apparently been able to repress latent homosexual tendencies until these were brought to the surface by his experiences abroad and his inability to adequately respond to the demands of a heterosexual situation upon his return home. The hallucinations seemed to clearly reflect his conflicts and he presented the picture of a rather typical acute homosexual panic.

Case 6.—This is a platoon sergeant, U. S. M. C., 24 years of age, single, with 3 years of active duty. He has always been a quiet, serious, rather shy individual, of superior intelligence and with a good school record. He served 28 months in Pacific combat areas, participating in 9 assault landings. He was in charge of a group of 13 men which acted as an outpost for his battalion, and it was necessary for him to remain in the comparative safety of the post, where he could have access to the communications system, while his men went on patrol. He gradually developed feelings of great guilt, believing that he

was letting his men down in not exposing himself to the same dangers that they encountered daily and fearing that they would look upon him as "yellow." On one occasion a Japanese soldier stumbled into his foxhole and in the ensuing fight was stabbed to death by the Marine. This incident was later frequently repeated in dreams in which the enemy was shown as the victor and the Marine was killed. Although he took part in further operations this man became increasingly irritable, morose, anxious, and experienced disturbing dreams reflecting his combat experiences. Having completed his overseas duty, he returned to the United States, where he was assigned to guard duty. His anxiety and feelings of guilt increased and hallucinations appeared. Discussing these he said: "I began to hear a voice calling my name—and then other voices began. I don't hear so many in the daytime—but more in the evening. They seem to stand at the foot of my bed and talk to me. Everybody tells me—and my common sense tells me—that they're not there. But they are as clear as your voice. They call my name—then I can hear a man screaming. It sounds like a friend of mine who called to me for help just before he was killed—and I couldn't help him. When I first heard the voices I'd ask everyone if they had called me—but no one had." The relationship of these experiences to the traumatic episodes seems quite definite and it is interesting to note that the situations were first reflected in conscious thinking, then in dreams, and finally in hallucinations. Although the original picture suggested combat fatigue, the final diagnosis was psychoneurosis, mixed type.

Case 7.—This is a SM3c, U. S. N. R., 23 years of age, divorced, with about 2½ years of active duty. He has always been a shy, rather dependent individual, who worked on his father's ranch and took little part in social activities, being closely attached to his family and particularly so to his mother. A devout Catholic, he has always found comfort in prayer and has been able to find some relief for his lack of sociability by attendance at the church. After entering the Navy he served nearly 2 years aboard a combat vessel which took part in many actions and suffered at least two seriously damaging hits. A few months before his hospitalization a younger brother of whom he was very fond was killed in action. Shortly after receiving the news of his brother's death, his ship was hit again, several men were killed, and he was later assigned to help bring the bodies from a portion of the ship where they had been sealed in for several days. The odor of decaying flesh was strong and the man began to smell this odor even after the ship had been cleaned and was at sea again. He became irritable, anxious, was unable to sleep well, and experienced terrifying dreams. Of these he said: "I would see a bunch of Japs chasing me—and I would have a gun—but when I'd shoot the gun would be empty. Those weren't things that had really happened to me—but I kept thinking about them." He began to dread combat more than ever before, had difficulty controlling his thoughts while awake, and was fearful of the dreams he experienced. One night, while he was on the bridge of his ship, contact with the enemy was established and he felt terrified. He said: "I just stood there on the bridge. There was nothing for me to do at the time. I thought of our farm at home and of mother and of what had happened to Dave (brother). Suddenly I heard mother's voice call my name. I looked around, but of course there was no one there. She called again and I thought maybe it was some sort of mental telepathy." Shortly after he was admitted to the sick list, showing confusion, apathy, vague ideas of reference, and marked emotional flattening.

This case is of interest as such incidents are commonly reported in the romantic literature of warfare and are often interpreted as religious experiences, etc.

The patient made a good recovery, the diagnosis of schizophrenia being made, although situational and hysterical features were marked. Before he left he said: "I don't know if there is really such a thing as mental telepathy or not. But on the night that I heard mother's voice she says that she suddenly felt that something was wrong and she thinks that I could really hear her say my name. Could that be possible, doctor?" Here psychiatric observation is brought into the realm of folklore—and the cautious physician may find it best to leave the convictions of the family untouched, being thankful only that the symptom has disappeared—and not quarrelling with the lack of insight.

DISCUSSION AND SUMMARY

It is not difficult to select from a large number of psychotic patients certain ones whose hallucinatory experiences seem to reflect rather directly underlying conflicts which may play an important role in the mechanism of the abnormal reaction. To do so, however, is not to explain all hallucinations. In many instances hallucinations may persist for years while the patient is able to make a fairly satisfactory social adjustment despite them. There may be no apparent organic cause for the phenomenon and superficial psychiatric examination may reveal no satisfactory explanation. More careful psychological investigation in such cases may be illuminating but this is not often possible in the military setting. Occasionally additional mental content may be obtained through the use of intravenous sodium pentothal or amytal narcosis (and hypnosis) and in this fashion the significance of certain hallucinatory material revealed.

As noted before, certain forms of hallucinations may be attributed to organic cerebral changes initiated by tumors, vascular disturbances, trauma, infection, toxic substances, types of cortical dysrhythmia, etc. In the great majority of patients expressing this symptom organic changes are not demonstrable. Some authors have insisted that hallucinations are actually false perceptions (illusions) and in all cases arise from a misinterpretation of actual stimulation of sensory end organs (34) (35) (41). Although the exact mechanism of a thought, a dream, and a hallucination are unknown, they would seem to be intimately related, the dream representing the thought in the sleeping state, while the hallucination is a form of thought projection in certain pathological states. There is considerable evidence to show that dreams reflect certain emotional conflicts and experiences (the battle dream is a striking example), and we believe that the hallucination is also very frequently an expression and indicator of such events.

The normal child may carry on a rich fantasy life in which he seeks escape from the domination of his elders and the situation in which he lives, and by means of which he may rather painlessly experiment with problems of living which he may face in reality at a later date. The activities of the child are limited by his environment

and his immaturity—the daydream affords him a bridge by which he may cross into the reality of life as he interprets it through fable, gossip, comic strip, observation of others, etc. In this way the fantasy serves a useful function, as the child learns to experiment with ideas, broadens his intellectual horizons, and develops the ability to constructively plan for the intangible future. Hallucinations are occasionally found in children and usually seem to be an exaggeration of the fantasy which the child uses to escape from a difficult situation or to make his position in the environment more tolerable.

In the adult fantasy continues as the daydream and is a useful and important part of living. The idle daydream is a source of comfort to the lonely and afflicted, the memories of the past being refurbished and their threads woven into the warp of the future. Controlled by the individual such fantasy enriches life and forms a basis for future action.

The dream may simply reflect that which has happened (the child dreams of the circus which he saw yesterday) or may express a wish for the future (the child pictures the circus which he hopes to see tomorrow). The combat dream with its tremendous emotional significance may be of the former type. Many dreams are more complex and apparently depict repressed material not entirely acceptable in the waking state, but appearing in the dream in distorted symbols of the thoughts they represent. The meaning or significance of all dreams is no more clear than is the significance of each thought, but in many cases a study of the dream may be extremely helpful in gaining further understanding of the patient's conflicts.

Hallucinations would seem to be a form of thought projection, but we do not know exactly how to explain transformation of a thought into what seems to the patient to be a true sensory stimulus. The mechanism remains obscure. The hallucination is of value to the patient as he thus projects untenable conflicts and so temporarily, at least, frees himself of their burden, or obtains a pseudogratiification of various wishes by an assumption of reality. These symptoms are of value to the physician in his effort to aid the patient as they often reflect repressed, unconscious material and may be important signs of conflicts that have an etiological relationship to the illness. Homesickness, social inadequacies, sexual conflicts, the fear of death—all the multitude of problems that beset the human in his effort to find and hold his place in the shifting, poorly controlled, unpredictable complexities that constitute modern society—such form the material for conscious thought.

If that material is unacceptable and painful it may be repressed only to reappear as more or less distorted figures in the dream. If it is pleasant the dream may also reflect it as a continuation of an en-

joyable event. The same material—repressed conflict or wish-fulfillment—may be extended into the hallucination, and we then deal with an extreme that must usually be looked upon as indication of an illness. Although the hallucination may arise as the result of any one of a number of factors—organic changes, toxic influences, neurological dysfunction, fear and fatigue, emotional conflicts—it is important to remember that the content expressed is the patient's own and an indirect reflection (simple or disguised) of his thought and affect. The causes of mental illness still lie largely unknown and each patient must be carefully investigated—medically, neurologically, and psychologically. In such investigation what the patient desires, says, thinks, and fears are important and must be considered. It is not enough to report that the patient "hears voices" or "sees a vision." These are but signposts, and the roads to which they point may often lead us nowhere—but at the end of some we may find the basic problems which concern our patients. And as we observe the apparent close relationship between thought, dream, and hallucination, and see the many causes for the latter, we will come to a better understanding of the subtle distinctions between mental health and disease and possibly be more chary of our use of the word "insanity."

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INSULIN SHOCK TREATMENT OF BRONCHIAL ASTHMA

Author's summary.—Out of a total of eight allergic bronchial asthma cases seven responded to insulin shock treatment, with complete disappearance of symptoms to the present time—i. e., from 8 months to 2½ years. One allergic case responded with a transitory subsidence lasting 5 months.

Three cases of nonallergic type bronchial asthma did not respond to this treatment although during the shock itself each of these patients felt relief for a few hours.

Insulin shock treatment in bronchial asthma seems to operate by means of a stimulus to the adrenal medullas, inducing a hyperproduction and dissipation of adrenaline; this action must be regarded as a defensive measure of the organism itself against the toxic action of massive doses of insulin.—GODŁOWSKI, Z. (Physiopathology Department of the Polish Medical School and Paderewski Memorial Hospital, Edinburgh): *British Medical Journal*, No. 4453, pp. 717-719, May 11, 1946.

APPENDICITIS IN A UNITED STATES NAVAL HOSPITAL

A Report of 2,404 Consecutive Cases With Emphasis on Fatal Cases

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Captain (MC) U. S. N. R.

Now that hostilities have ceased, it is believed that there might be a certain interest in reviewing as frequently a discussed subject as appendicitis; reviewing and considering all of the cases for a period of 3 years in a newly established U. S. naval hospital. There has been so much interest in, and so much written about war casualties that to have brought this subject up earlier might have been out of place. So just before returning to civilian practice, all of the cases operated upon for appendicitis in this Naval Hospital were reviewed and certain facts emphasized which seemed pertinent. There are no new methods and no new or startling discoveries, but the author believes that some things have been unduly emphasized in the past and that other things have not had the attention they deserve.

These operations have been done by many different surgeons from the rank of lieutenant (jg) to captain, with experience in surgery varying from a few months to a quarter of a century. But always an effort at careful, adequate supervision was made.

There are certain advantages in doing surgery in a naval hospital. Routine can be standardized. The chief of surgery is in charge and has the authority to see that only recognized and standardized practices are carried out. All cases except emergencies are reviewed by the entire surgical staff at a daily conference where the consensus of all opinions is obtained.

The time covered by this presentation is from November 1942 to November 1945, during which time 2,404 patients were operated upon for appendicitis. In a recent personal communication from Capt. Gerard B. Creagh (MC) U. S. N., present Chief of Surgery at the U. S. Naval Hospital, Norfolk, Va., an additional 346 cases of appendicitis, 9 of which were perforated, without any deaths, were reported. This group, occurring in the subsequent 12 months to this report, if added to this series of cases, would make 2,750 consecutive operations

for appendicitis with 6 deaths. The ages of the patients varied from under 2 years to over 70 years, but the great majority of them were from 17 years to 30 years of age. In evaluating this report, it must be borne in mind that most of these patients were of the age optimum for the best postoperative results. All of these patients, except dependents, were in the service and were in excellent physical condition.

There were 2,093 cases diagnosed as "acute," but Navy nomenclature gives only 2 choices of diagnosis of uncomplicated appendicitis, namely, acute and chronic. Some of these cases in civilian practice would be called subacute appendicitis, recurrent appendicitis, mechanical appendix or an operation might be considered an interval one.

There were 306 cases of chronic appendicitis, some of which were incidental operations. There was 1 case of carcinoid of the appendix. Some of the cases classed as acute or chronic appendicitis were fairly innocent looking and, of course, many would have subsided without operation.

There were 90 cases (3.7 percent) of ruptured appendix with suppurating, spreading peritonitis. This number would seem to be unduly large when it is borne in mind that in most instances adequate surgical facilities were readily available for immediate treatment, but some were from small ships where ideal surgical treatment was not promptly available.

In this series, there were 6 deaths, a mortality rate of 0.24 percent or 1 to 400, and it is interesting to note that of the patients who died, only 1 had a ruptured appendix with peritonitis (1) (2) (3) (4).

Of the 113 operators, many were interns and many were young doctors just beginning their naval service. It was our duty to teach these young medical officers how to do an appendectomy if circumstances should demand it in some field hospital or on some small ship.

The types of anesthetics differed in percentage somewhat from those used in civilian hospitals (5). They were as follows: 2,269 spinals (94 percent); 26 continuous spinal (1 percent); 1 spinal and local; 61 spinal and general (3 percent); 45 general (2 percent) and 1 local. Therefore, spinal anesthesia in some form was given in 98 percent of the cases.

There are certain advantages in the use of spinal anesthesia in these young and otherwise healthy patients. Continuous spinal anesthesia in an emergency operation at night, when additional assistance cannot be easily obtained, or when the patient is fat or critically ill, cannot be recommended too highly. The author believes, in this series, that continuous spinal anesthesia could have been used more frequently to advantage, both to the patient and to the operator who occasionally found that a difficult operation took longer than

anticipated. One patient who had been given spinal anesthesia died in the operating room as a result of the anesthetic.

There has been much said about the value of one incision over another. Some have claimed that when the McBurney incision was used exclusively in some institutions, the mortality rate in appendicitis dropped 50 percent (5). That statement, in the opinion of the writer, could not be true, all other factors being the same.

There is considerable difference of opinion as to whether it is safer to tie off the stump and not invert it, or to invert or oversew the stump after ligation. Perhaps either method carefully done would be satisfactory, but in our opinion, all things being considered, it is a safer general practice to invert or oversew the stump. This is a practice which we have always followed and have never found any reason to depart from, except occasionally when there is too much edema and induration of the cecum to allow satisfactory inversion of the stump. If there is any doubt about the security of the procedure, drainage should be instituted. If only ligation is done, it is wise to doubly ligate the stump. Three of the patients who died did not have the stump inverted and, in two of these cases, complications were not expected following operation. We are not sure that failure to invert the stump did not play a part in the unexpected unfavorable outcome.

Indications for an appendectomy differ slightly in the Navy from civilian practice. If there is no contraindication to an appendectomy, the operation is performed in borderline cases, since it is felt that it is safer to operate on patients with a mild attack when conditions are ideal, even though the attack may be expected to subside. A recurrence may take place aboard a small ship, at some outpost or during some action when surgery must be delayed or done under unfavorable circumstances. These same circumstances are not present in civilian practice; and in the Navy, the surgeon cannot be accused of operating for a fee only.

Before any patient is operated on, an adequate history is taken and physical examination done, as well as a urine and blood examination. The temperature, pulse, leukocyte and differential count are evaluated, but the history and physical examination are of more value.

The preoperative treatment and medication are not unusual. The patient's abdomen is prepared in the emergency room or ward by operating room corpsmen and a sedative (barbiturate) and a hypodermic of morphine and atropine are given. If the patient is dehydrated, intravenous solutions of dextrose or plasma are given.

In all naval hospitals, there is a surgical watch which means that there is always a capable surgeon on duty, usually for 24 hours at a time. The operating rooms and the laboratory were not closed at

night and an operating room crew and a laboratory technician were ready for calls at all times. This arrangement was most satisfactory, obviating the long delays so often seen in civilian hospitals.

Routine postoperative treatment very similar to that in the average civilian hospital was carried out. Skin sutures were removed on the seventh day and patients usually were not allowed up until the seventh or tenth day, but they were given courses of gradually increasing exercises by our rehabilitation officers and their staffs so that the usual uncomplicated case of appendicitis was referred back to duty 14 days after operation.

In the case of spreading peritonitis or rupture of the appendix, certain additional procedures were followed. One, two, or three small cigarette drains were inserted, and removed in from 3 to 8 days (5) (6). Four grams of sulfanilamide were placed in the abdomen (6). Whether this was necessary or advisable may be open to doubt, but there never was any cause to regret its use. Usually the patient was placed in the Fowler position and Wangensteen suction always instituted on the principle that it was easier to prevent than to relieve distension after its onset. The patient was encouraged to move promptly after operation, take deep breaths and cough up any phlegm or mucus in an effort to prevent pulmonary atelectasis. Only one patient required a bronchoscopic drainage postoperatively. If there was any dyspnea or cyanosis, the patient was placed in an oxygen tent. Penicillin, sulfadiazine, vitamins, blood, blood plasma and dextrose in saline or distilled water were administered. Feedings by mouth were begun cautiously and gradually after a few days (usually from 2 to 4 days).

Emphasis is again placed on the importance of rehabilitation exercises, and the various ward entertainments and activities provided to keep the patient's morale high. This receives more emphasis in military hospitals than in civilian.

All dirty cases were placed in a special ward and were segregated from clean cases. This practice likewise is not usually followed in civilian hospitals.

The operative procedure was written up promptly before the operator left the operating room. To delay in writing up an operation is a careless, slovenly habit which often leads to inaccurate information about the operative procedure or the pathology found, and if the description is referred to later, an error in subsequent diagnosis or treatment may result. Careful and adequate postoperative and final notes should not be omitted and any complication should be accurately recorded.

There were no incisional herniae noted in the cases where drainage was instituted.

As stated before, there were six deaths in this series as follows:

CASE REPORTS

Case 1.— S. S. T., S2c, age 18 years, was admitted on 9 December 1943 and was operated upon 2 days later for chronic appendicitis. No technical difficulty was encountered at operation. On 16 December 1943 he developed signs of peritonitis and pneumonia and became progressively worse. The abdominal wound was opened on 18 December 1943 and pus evacuated. The patient died on the eleventh postoperative day. The pathological report was chronic appendicitis.

The autopsy revealed an unhealed McBurney incision 10 cm. in length, the lower 7 cm. of which were widely open and exhibited an acute, suppurative inflammation with thick, greenish pus in its depths. On opening the abdominal cavity, a quantity of foul-smelling, thick, greenish pus escaped under considerable pressure. The appendiceal stump was carefully exposed; the sutures around it were still secure but there was a perforation in the cecum, perhaps

CLINICAL CHART

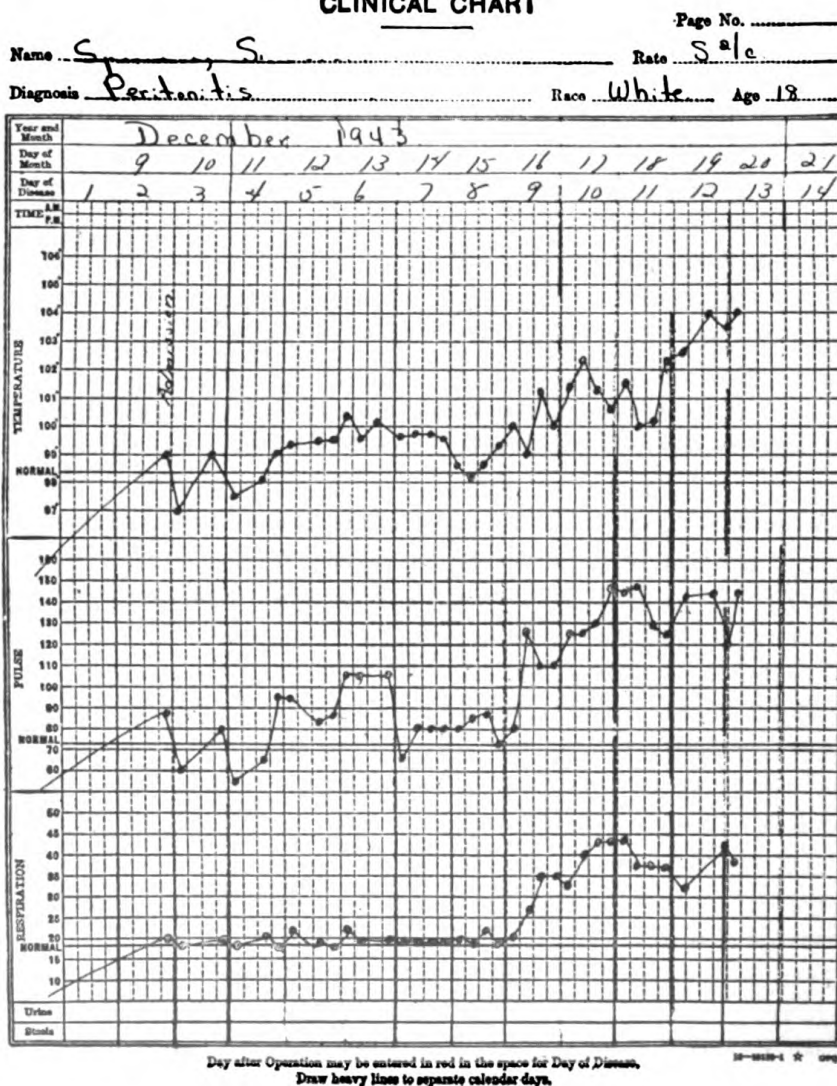


FIGURE 1.

2 cm. in diameter. This perforation was covered on the peritoneal side by a thick layer of semiorganized exudate, but the perforation penetrated entirely through the bowel wall.

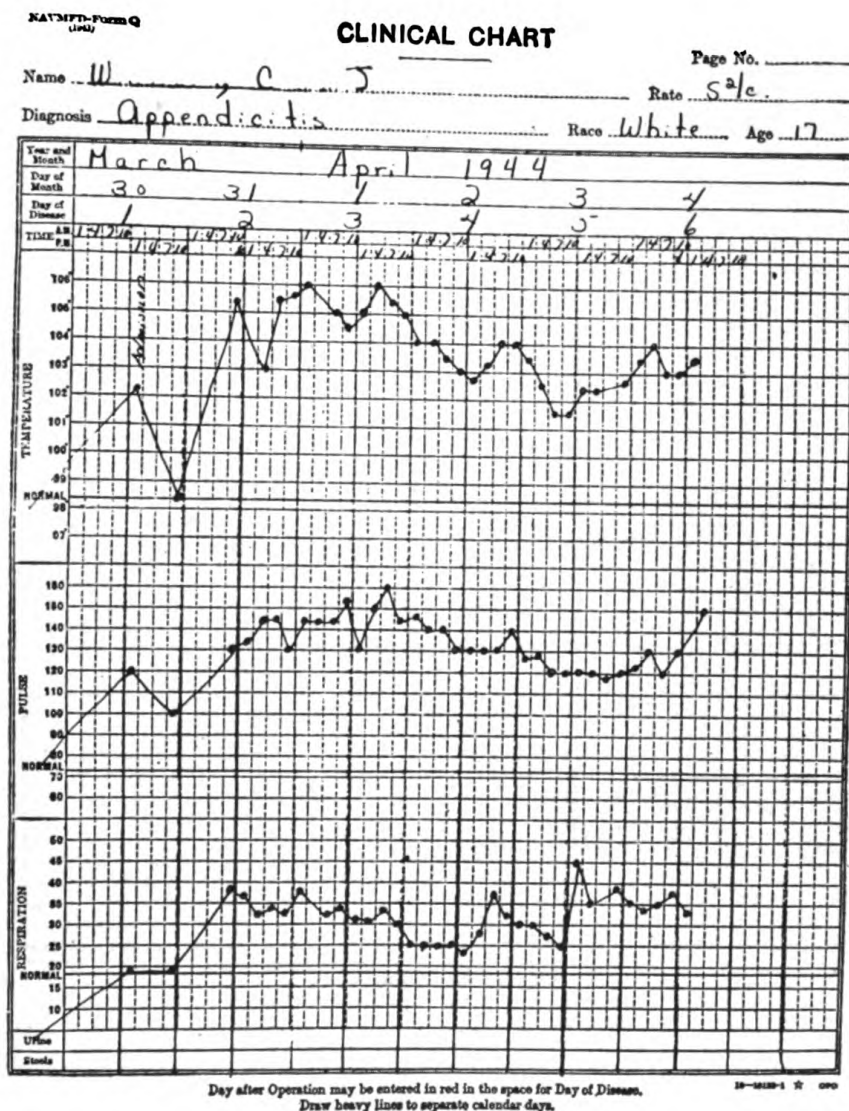


FIGURE 2.

Case 2.—C. J. W., S2c, age 17, was admitted on 30 March 1944 with acute onset of severe right lower abdominal pain preceded by transitory weakness of legs and followed by nausea and vomiting. He had had a head cold 2 weeks before admission. Physical examination revealed flushed skin, injected conjunctivae and pharynx. There were abdominal rigidity and tenderness. The temperature was 102.2° F., pulse 120, and respirations 18. X-ray of the chest was negative. A diagnosis of acute appendicitis was made and operation was performed. The appendix was acutely inflamed and the tip was bulbous and covered with grayish exudate. No technical difficulty was encountered and there was no drainage. Following operation under spinal anesthesia, the

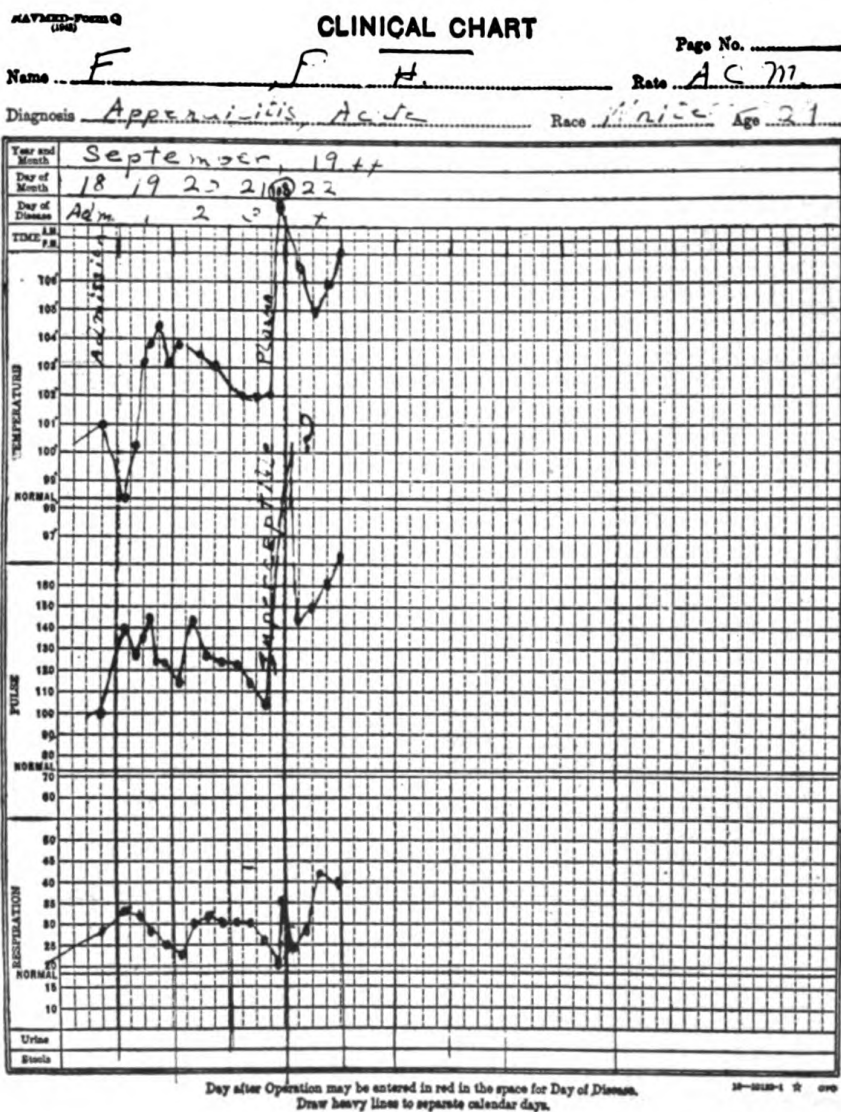


FIGURE 3.

temperature rose to 105° F. Chest x-rays, blood cultures, spinal fluid examination, etc., were negative. Eye, nose, and throat examination on 31 March 1944 revealed a red throat, muco-pus and nasopharynx and both tympana thick and red. Bilateral myringotomy was performed. The patient was placed in an oxygen tent immediately and given plasma, intravenous dextrose, sulfadiazine, and Wangenstein suction, and penicillin. He went downhill steadily and died on the sixth postoperative day.

The autopsy revealed 600 cc. of dark, clear fluid in the right pleural cavity and 400 cc. in the left. The right auricle was markedly dilated and the right ventricle moderately dilated, with its epicardium thickened. The abdomen contained 1 liter of greenish, turbid fluid, with membranous exudate. The appendiceal stump was well ligated and there was no surrounding exudate.

This patient apparently had an overwhelming generalized infection.

Case 3.—P. H. F., AGM, age 29, was admitted on 18 September 1944 with a history of pain in the upper abdomen of 3 days' duration, with one previous attack at the age of 12 years. Physical examination revealed abdominal distension and rigidity. The patient was of a religious group opposed to medical treatment and there had been a delay for 3 days prior to admission to the hospital. Laparotomy revealed much turbid fluid in the abdomen with greenish, yellowish pus around the appendiceal region. A gangrenous appendix was removed through a right rectus incision and the abdomen drained. The appendiceal stump was ligated doubly and not inverted. His condition showed steady improvement until 22 September 1944 when he had a severe chill at 0800 after having received 400 cc. of blood plasma intravenously. Following the chill, his temperature rose to 106° F., pulse became imperceptible and at 1500 the temperature was 107° F., pulse 154, and respirations 42. At 1800, he took a definite turn for the worse, the pulse being imperceptible, respirations rapid and at times Cheyne-Stokes in character, and he expired at 1845, 22 September 1944, the fourth postoperative day.

The autopsy revealed pockets of serofibrinous and purulent exudate. The ligatures about the stump were intact.

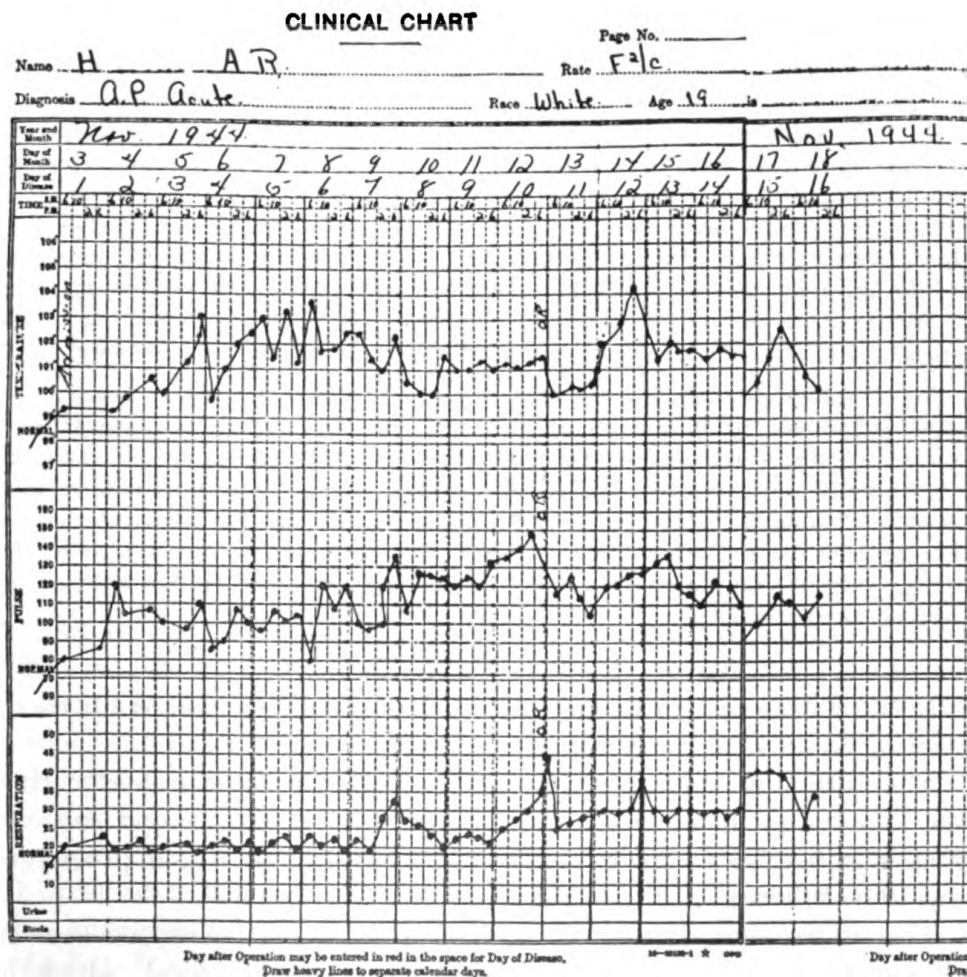


FIGURE 4.

Case 4.—A. R. H., F2c, age 19, was admitted from a ship on 3 November 1944 with a history of right lower quadrant pain of 3 days' duration. An acutely inflamed appendix was removed the same day through a McBurney incision. There was no free fluid. The appendix, which was injected, was bound down to the posterior peritoneal wall by dense adhesions. The stump was not inverted and the abdomen was closed without drainage. His abdomen was distended at this time and the distension persisted. On the ninth postoperative day, the appendectomy incision was reopened under local anesthesia and about 1,000 cc. of serosanguineous material, apparently under pressure, was evacuated from the peritoneal cavity. No bleeding point was seen. Blood was present in the gastric contents, in the stools and in the urine in large amounts. The patient's prothrombin level was $33\frac{1}{3}$ percent of normal. He died on the sixteenth postoperative day.

Autopsy revealed a spreading peritonitis and large collections of turbid fluid. The right pleural cavity contained 1,000 cc. of clear yellow fluid. Several peptic ulcers revealed severe hemorrhage. There were four erosions on the mucosa of the cecum. The appendiceal stump was 1 cm. long and buried in a mass of dark, fibrinous adhesions. The stump was not inverted and appeared open.

Case 5.—A. J. O., MM2c, age 19, was admitted on 18 June 1945 with a temperature of 101° F. and a leukocyte count of 17,950. An acutely inflamed appendix was removed promptly under spinal anesthesia. The stump was not inverted. Progress was satisfactory for 3 days, at which time the patient became distended with toxic manifestations of rapidly spreading peritonitis until his death on 27 June 1945. The pathological report showed an acutely swollen, greenish discolored appendix with necrosis of the mucosa.

Autopsy revealed fibrinous exudate and a poorly walled-off cavity along the right lateral gutter. As the cecum was carefully pulled medially, the stump of the appendix opened and discharged fecal material. The peritoneal edges of the stump were soft and necrotic. 500 cc. of dark, bloody fluid were in the pelvis. Similar pockets of fluid were present between the coils of bowel.

Case 6.—Mrs. B., age 33, was admitted on 19 July 1945 with a history and physical findings typical of acute appendicitis. Nembutal, 3 grains, and morphine sulfate, $\frac{1}{4}$ grain were given preoperatively and 150 milligrams of procaine intraspinally, with no effect; 1.5 cc. of 20 percent metycaine solution were then given intraspinally. Respiratory difficulty developed and the usual resuscitation methods were used without success. The pathological report showed the entire wall of the appendix to be necrotic (gangrenous appendicitis). No autopsy was performed.

CONCLUSIONS

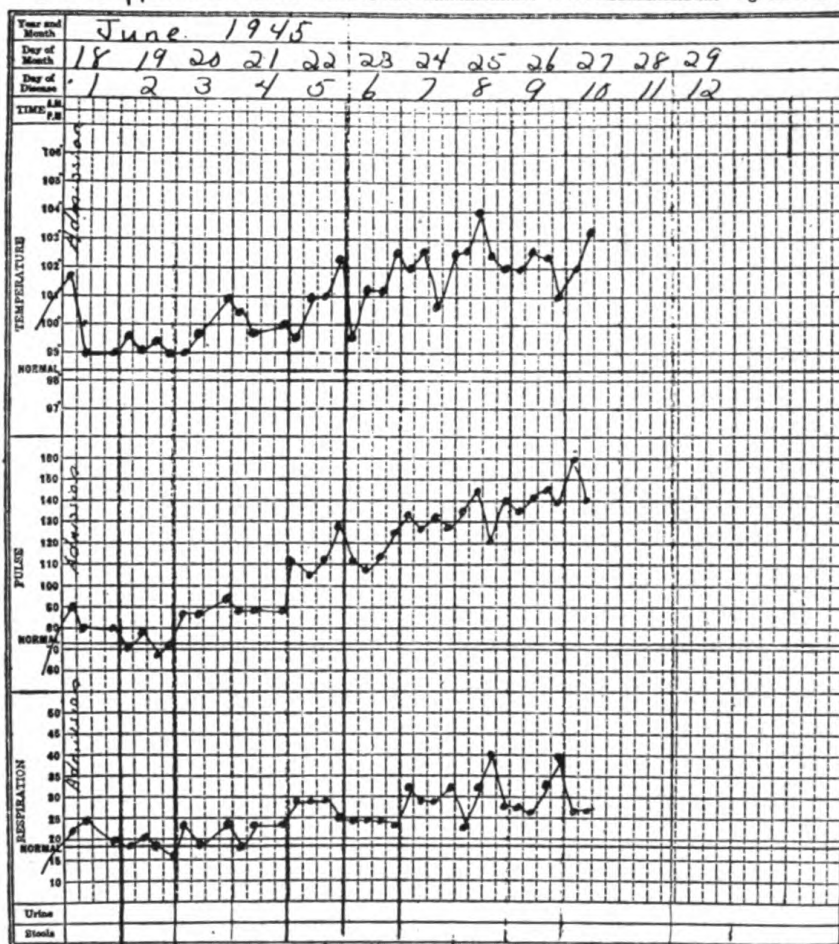
It is the opinion of the author that the type of incision has little or nothing to do with the mortality rate (5).

The author is convinced that inversion of the stump is safer, but one is reluctant to dictate the technique that an experienced surgeon wishes to use, so no rules were made in regard to which procedure was to be followed in these cases.

The tissues should be handled with extreme gentleness and care at all times. If clamps or forceps are used on the bowel, which is usually not necessary, they should not be clamped tightly and should

CLINICAL CHART

Name O. A. Page No. _____
 Rate h. a. mm²/c.
 Diagnosis Appendicitis Acute Race White Age 19



Day after Operation may be entered in red in the space for Day of Disease.
 Draw heavy lines to separate calendar days.

FIGURE 5.

not be left on longer than is absolutely necessary. They can cause areas of necrosis, which probably occurred in two of our patients.

If pus is suspected, packs should be placed before any exploration is done, and if pus is found, it should be promptly aspirated. Cultures should be taken and, if possible, the appendix should always be removed.

Cigarette drains are used when drainage is considered necessary. It is better to use two or three small drains than one large drain, so that they can be removed one at a time if there is any damming back of pus. The drains are removed in from 1 to 10 days, usually in from 3 to 7 days.

Spinal anesthesia was used in over 98 percent of the cases. Continuous spinal anesthesia should be used more frequently, especially in obese or critically ill patients.

Surgery should be done only by experienced surgeons or they should be available as assistants to advise and help. Conservative, non-operative treatment should be advised if capable surgeons and proper facilities are not available.

As many as 8 to 12 appendectomies were done in one 24-hour period and as many as 4 to 6 in 1 night. The operating room and laboratory were always open; specimens were always sent to the laboratory for examination, and the operations were always written up promptly.

Change in diet and habits of these patients may have made the incidence of appendicitis higher in the service.

There is a definite danger in referring questionable cases back to duty unoperated.

In this series of cases of 2,404 consecutive appendectomies over a 3-year period, there were 6 deaths. One was an anesthetic death (and the only anesthetic death during the author's 21½-month tour of duty at this hospital where about 5,000 operations were done each year). Another death was probably due to a plasma reaction but since he had a severe peritonitis, his death was attributed to that. This was the only patient with a perforated appendix who died in the series. One other patient had a severe, generalized, overwhelming infection. The remaining 3 deaths were not to be expected from the description of pathology found at operation. In 2 cases where the appendix was not inverted there may have been some faulty technique. In 4 cases, the appendix was not inverted.

In retrospect, it would seem that it is within the realm of possibility to have had a similar series of cases with no deaths or at least with fewer deaths. If there were no errors in technique or judgment, death from appendicitis in an otherwise healthy person should rarely occur.

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THE LOCAL TREATMENT OF FURUNCULOSIS WITH PENICILLIN

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The furuncle is among the most common abscesses of the skin. Its treatment was a problem when lancets were still being made of wood, bone, and stone. Methods of treatment of the furuncle are legion. Practically every medicament known to man has been applied in one form or another with watchful expectancy. Regardless of the weird concoctions to which it has been subjected we still depend upon the fact that the uncomplicated lesion will heal spontaneously in from 1 to 3 weeks. Because of this fact we have come to assume a false sense of security. The complications arising from neglected furuncles are more frequent than one would expect. Deaths are still occurring every day. The report by Theis and Frazier¹ of a case of fulminating hemolytic staphylococcus aureus infection arising from a furuncle is an example of the perilous course such a neglected lesion may take.

The furuncle, or boil, is generally described as being an abscess of the skin involving a hair follicle or sweat gland. It may occur alone or there may be several lesions. The posterior aspect of the neck where the hair is most abundant, the buttocks, the thighs, and the axillae are the most common sites. The gross appearance of the furuncle is so well known that its present description is unnecessary.

The etiology of the furuncle is not completely understood. In some cases the lesion appears to arise as a result of mechanical, chemical, or thermal irritation of the skin, or a combination of these. In other cases there is evidence to indicate that it may result from general disturbance of the normal metabolism of the skin with subsequent disruption of the antibacterial barrier. The organism most often isolated from these lesions is the *Staphylococcus aureus*.

Probably the most popular treatment in recent years has been the application of heat to the furuncle to localize it, followed by incision

¹ THEIS, F. V., and FRAZIER, S. H.: Fulminating hemolytic *Staphylococcus aureus* infections; recovery following penicillin therapy. U. S. Nav. M. Bull. 47: 163-170, Jan.-Feb. 1947.

if spontaneous rupture of the overlying skin did not provide sufficient drainage. The classical crucial incision results in a cicatrix that in many instances is quite extensive and disfiguring. The inadequately treated furuncle may be the source of satellite lesions, carbuncles, or result in septicemia with a grave prognosis. It is therefore highly desirable that the furuncle be treated early and adequately.

In penicillin, now available at a reasonable price, we have a drug which far surpasses any other in the treatment of furunculosis. That it is most effective when brought in direct contact with susceptible bacteria, is a fact that was established early in the history of the drug. The intramuscular route of administration will bring penicillin in contact with the bacteria within the furuncle, but in order to maintain an adequate blood level without using a special vehicle for the penicillin requires frequent periodic injections which is a decided disadvantage.

Topical application of penicillin does not result in bringing the drug in contact with the bacteria deep within the furuncle, since penetration of the skin is minimal and the opening, if any, is usually occluded by exudate.

Local injection of the penicillin directly into the furuncle is the only means of delivering the highest concentration of the drug to the desired site with the lowest total dosage. This method of treatment was begun by the author at a U. S. Naval Hospital in September 1945, and the first 50 cases, together with a separate series of 14 similar cases treated by local injection, moist heat, and incision only, form the basis for this report. Attention is invited to an excellent report by Rose and Hurwitz² dealing with the regional injection of penicillin in local infections in which they included 2 cases of furunculosis.

A solution of penicillin containing 20,000 units per cubic centimeter was the most frequently used. A 2-cc. syringe was used with a 1-inch, 26-gage needle, it being found that the introduction of a needle of this size causes very little pain. Insertion was made at an angle beneath the skin at the perimeter of the furuncle just beyond the area of erythema. The point of the needle was then directed to the center of the base of the lesion and from 0.5 to 1.0 cubic centimeter of the penicillin solution was injected, the amount being dependent upon the size of the lesion. If the furuncle was at the stage of pointing, the increased pressure would frequently cause the top to rupture and the injected fluid could be seen emitting from the opening together with a varying amount of exudate. The needle was then withdrawn. If the cap of the pointed lesion was too tough to rupture spontaneously at the time of injection it was nicked aseptically with the point of a sterile hypo-

² ROSE, D., and HURWITZ, D.: Regional injection of penicillin in local infections; preliminary report. *New England J. Med.* 234: 291-296, Feb. 28, 1946.

dermic needle. Extensive incision was unnecessary and felt to be undesirable. A small, dry sterile piece of gauze was the only dressing applied.

A furuncle of average size, treated in the above described manner, usually showed marked regression in 24 to 48 hours. Often at the end of 72 hours it was difficult to find any trace of the furuncle except for a very tiny pit in the skin. If the furuncle did not show marked regression the day following injection, it was injected again. Even with quite large furuncles it was seldom necessary to inject more than twice. The average lesion required only one injection. Exudate from these was thin and small in amount. Furuncles in all stages of development were injected with equally good results. Those injected in the early stage seldom came to a point and as a rule disappeared rapidly. The alleviation of pain within 12 to 24 hours after injection was noteworthy. Except in a few instances, no attempt was made to identify the pathogens. All of the patients were ambulatory. The average healing time for a furuncle in this series was approximately 4 days.

CASE REPORT

A white male, 20 years of age, was admitted to a U. S. Naval Hospital in September 1945 complaining of a series of painful furuncles in various places on the skin for approximately 6 weeks. At no time during that period was he completely free of them. Certain of the more advanced lesions had been incised from time to time and subsequently healed in from 10 to 14 days. Physical examination revealed the presence of 9 furuncles ranging from small to medium size and in all stages of development. These were located discretely on the thighs, back, buttocks, axillae, and posterior aspect of the neck. In all other respects the patient appeared in good health. Routine laboratory examinations of the blood and urine, including a Kahn test, were within normal limits. All furuncles regardless of their stage of development were injected in the manner described above. Forty-eight hours later four of these were almost completely healed. The remaining five showed marked regression and were no longer painful. Seventy-two hours later the original nine lesions were practically healed, but three new ones in an early stage were discovered on the buttocks. These were injected and at the end of 48 hours were found to be healed. A follow-up of the patient 1 month later revealed that no other furuncles had occurred. There were no scars at the sites of the previously injected furuncles.

CONTROL CASES

In a separate group of 14 cases of furunculosis local moist heat alone was applied and incisions made when adequate spontaneous drainage did not occur, and then only when the lesions were localized. The heat was continued after incision. The wounds were kept open by probing as long as the need for drainage was evident. The exudate from these furuncles was thick and copious and there was considerable sloughing. Pain was a constant symptom until the induration about the lesions

had subsided. In all cases incised, scars proportional to the size of the incisions and tissue destruction were present after healing of the lesions. The average healing time in this group was approximately 11 days.

SUMMARY

1. In a series of 50 cases of furunculosis in which the furuncles were treated by local injection of penicillin solution, the average healing time was 4 days as compared with 11 days for the controls.

2. The average healing time in the penicillin treated cases was approximately 64 percent faster than in the controls.

3. The penicillin-treated cases had far less pain, no complications, scar formation was negligible, the lesions drained far less exudate, and the majority required only one injection.

4. Incisions were not necessary in the penicillin treated cases and no special concern was given to drainage.

5. There were no complications attributed to the local injection of the drug.

6. The treatment described is simple and applicable to any naval activity where penicillin is available.

COMMENT

1. Although a furuncle on the inside of the nose was not treated in the present series it is the author's opinion that in view of the danger of infections in these areas, hot moist compresses should be applied and the penicillin given parenterally rather than locally. One should not hesitate to supplement the local injections with large parenterally administered doses of penicillin whenever indicated, such as in cases showing evidence of a generalized infection.

2. Many cases subsequent to the series reported have been injected with as much as 100,000 units of penicillin in 1.0 cubic centimeter without ill effect. Solutions containing 50,000 units per cubic centimeter are now being used routinely in all cases. The higher concentrations have been found more practical, particularly in the case of paronychia infections of the fingers and badly infected in-growing toenails where the elasticity of the tissues is limited. Results in the latter infections have been just as good as in the case of furuncles and no felons have developed.

3. It would seem that in view of the past experience with breast and palmar space abscesses, these too should respond well to local injection with penicillin. It is hoped that this report will stimulate further investigation of this method of treatment in such cases.

4. The simplicity of the treatment described and the excellent results obtained in furuncles makes the use of routine incisions, various ointments, poultices, and sulfonamide crystals obsolete in their treatment.



CHLOROPHYLL IN WOUND HEALING AND SUPPURATIVE DISEASE

In over 400 cases treated with preparations of chlorophyll at the Winter General Hospital convincing clinical evidence of the efficacy of chlorophyll in the treatment of infected wounds was obtained.

When chlorophyll was used there was a rapid disappearance of objectionable odors and a remarkable cleanliness of the wound in 2 or 3 days.

"Granulation tissue seemed to be of finer texture, more firm and to form more rapidly with chlorophyll than with other agents previously used."

Epithelization appeared to be stimulated more by chlorophyll than by other agents.

No skin irritation or adverse systemic reactions were noted and patients found wet dressings more comfortable than similar dressings with saline solution, boric acid solution, or penicillin.

"If chlorophyll is used as a wet dressing over a period of a week or more, there is a tendency to overproduction of granulation tissue so that after the wound is clean and odorless it is advocated that chlorophyll ointment gauze be used instead of the wet dressing."

"It was noted in all suppurating cases that chlorophyll caused cessation of pus formation in 2 or 3 days; and thenceforth, there was only a slight serous discharge. This includes the osteomyelitis and thoracic empyema cases which are noted for prolonged suppuration by other modes of treatment."

In the nose and sinus cases it was noted that chlorophyll gave more rapid changes in the nasal mucosa, and had a quicker effect in stopping purulent drainage than other agents formerly used. Chlorophyll instillation was without the disagreeable after-effects of ephedrine.

Chlorophyll is not antibacterial and is but weakly bacteriostatic so that its beneficial effect is exerted through stimulation of the cells of the host.

The author believes that the water-soluble chlorophyll preparations described have a broad military application and that wide use is highly desirable, and is convinced that chlorophyll is the best agent now known for use in the treatment of chronic suppurative diseases, indolent ulcers or wherever stimulation of tissue repair is desired and local application of this drug is possible.—BOWERS, W. F.: *American Journal of Surgery* 73: 37-49, January 1947.

THE EVE METHOD OF RESUSCITATION

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For many years there has been much debate as to the relative merits of various methods for maintaining artificial ventilation of the lungs of the apparently drowned, or an apneic patient in shock. The method generally recommended and officially adopted by the American Red Cross is, of course, the Schafer method. The principal advantage of the Schafer method over a good many others is the fact that it requires no special apparatus and can be carried out in almost any conceivable location; however, a method depending on a different principle has recently been adopted for use aboard rescue and crash boats at the

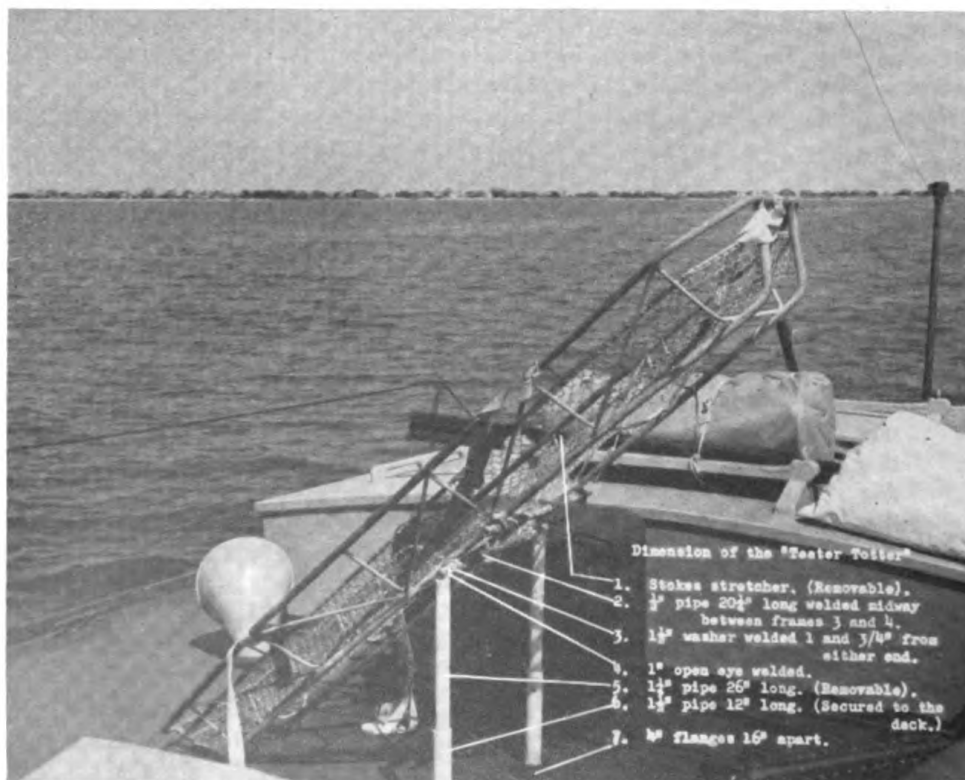


FIGURE 1.

U. S. Naval Air Station, Norfolk, Va. This method, known as the Eve method, which is named after a British physician, requires a method of tilting the patient down and then up upon a board or stretcher balanced in the middle. Figures 1, 2, 3, and 4, illustrate the method in which we have adapted the Stokes stretcher for use aboard crash boats in order to carry out Eve's maneuver.

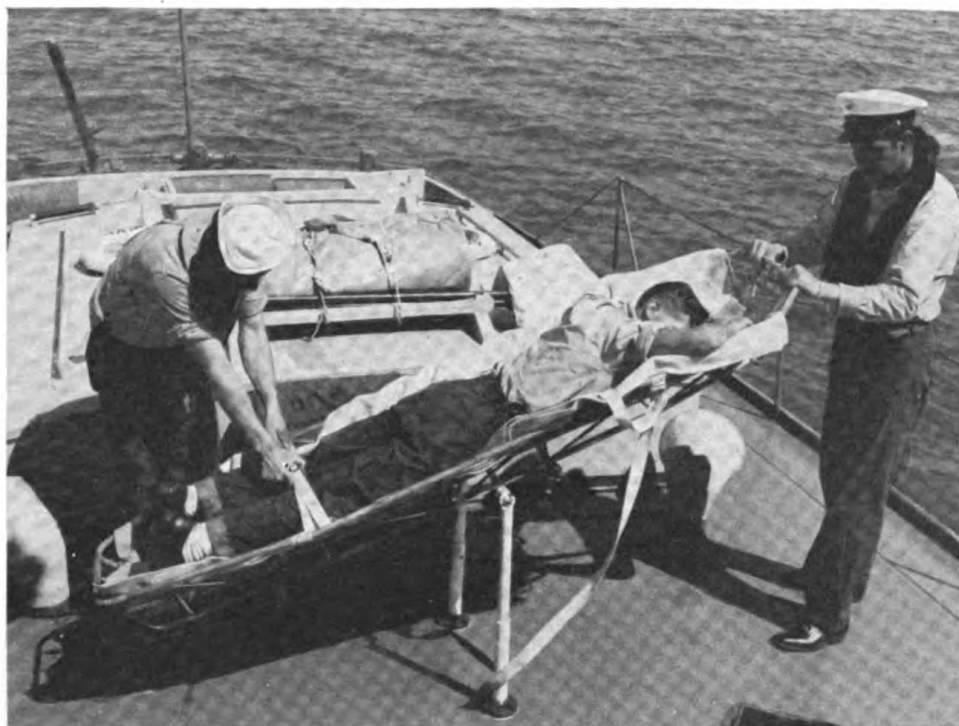


FIGURE 2.

Although Dr. Eve discovered the tilting or rocking method of treatment of apneic individuals and forthwith began to employ it as long ago as 1932; and although the Eve method is recommended by the Royal Navy in preference to other methods; it does not seem to have attracted a sufficient interest in this country on the part of the investigators in the field of artificial respiration to have been made the subject of tests in comparison with other methods. As far as the writer can discover, an actual comparison of the relative efficiency of the Eve and Schafer methods has been made in only five subjects. Three of these subjects were first rendered apneic under deep anesthesia by hyperventilation. The two remaining subjects had suffered complete respiratory failure following severe intracranial injuries.



FIGURE 3.

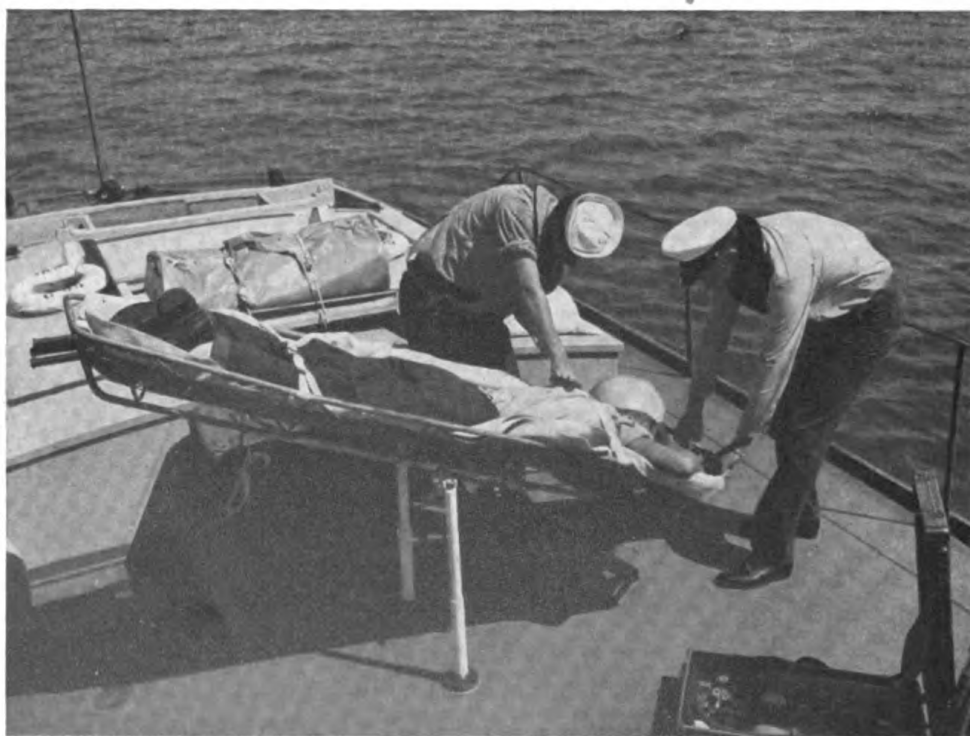


FIGURE 4.

TABLE 1.—*A comparison of Schafer and Eve methods (4)*

	Tidal air	
	Schafer	Eve
	cc.	cc.
Waters and Bennett (1).....	160	150
MacIntosh (2).....	340	580
Eve (3).....	530	850

The confidence placed in the Schafer method is due mainly to the more than adequate exchange of tidal air (360 to 1,000 cc.) obtained on healthy subjects who have voluntarily suspended breathing. The physiological state of the apparently drowned, asphyxiated, or electrically shocked patients parallels more closely the state of the patients in table 2 than the state of healthy subjects, consequently, the relative inefficiency, or rather inadequacy, of the Schafer method to produce an adequate exchange of tidal air, as shown in table 2, clearly demonstrates that this method fails when most needed.

TABLE 2.—*Comparison of Schafer and Eve methods on 2 apneic, asphyctic patients (4)*

Patient	Tidal air		Rate	
	Schafer	Eve	Schafer	Eve
	cc.	cc.	cc. per min.	cc. per min.
C. M.	117	500	12	12
B. R.	71.5	286	14	14
	95.0	312	21	16

The manner in which Eve discovered the rocking method of resuscitation is of interest (5). He stumbled onto it in 1932 when he used a rocking chair to treat a 2-year-old girl, who, while convalescing from diphtheria, developed paralysis of the diaphragm and was dying of a "death rattle." He placed the child in a head-down position to secure pharyngeal drainage, but fearing such a position, if continuous, would compress the lungs and lead to pneumonia, he conceived the idea of alternating the head-up and head-down positions, using a rocking chair. This procedure not only produced adequate drainage, but also relieved the child's breathing. The rocking was continued for 2½ days until the diaphragm regained its tone. The child then made an uneventful recovery.

Eve's method is simplicity in itself, requiring merely a sturdy back, a sense of rhythm, and a "teeter-totter" of any design. As can be seen from figures 1, 2, 3, and 4, the "teeter-totters" constructed for use aboard the crash boats at U. S. Naval Air Station, Norfolk, Va., consist of a modified Stokes stretcher and a pair of vertical supports. A

cross bar welded across the bottom of the stretcher approximately in the middle serves as a fulcrum. Installed on the middeck of each crash boat is a pair of vertical standards with an open eye on each end to receive the fulcrum. These standards are of such height as to permit a 45° depression of either end of the stretcher. The machine is constructed in sections to facilitate stowage when not in use.

In operation, a prone patient is tilted 45° each way through the horizontal at a rate of 10 to 12 cycles per minute. (Head-up to head-down is one cycle.) Without any loss of time the patient is placed

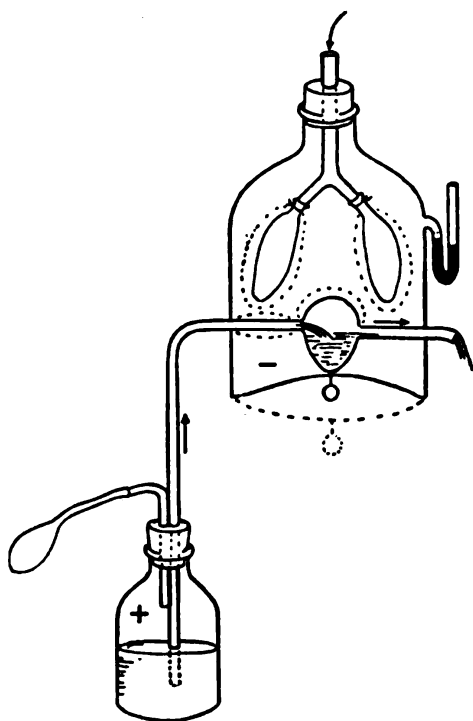


FIGURE 5.¹—Model to illustrate the manner by which changes in thoracic capacity cause corresponding changes in the volume of air in the lungs and affect the return of blood to the heart. The large glass chamber represents the thorax; it is hermetically sealed and has a flexible bottom or diaphragm. The Y-tube, which is in communication with the atmosphere, represents the trachea and bronchi; the lungs are represented by the attached balloons composed of thin rubber. The pressure within the chamber, i. e., surrounding the balloons is subatmospheric to start with; the balloons are therefore partially expanded. When the diaphragm is drawn down (as indicated by the dotted lines) the pressure within the chamber is further reduced. The rubber balloons are distended to a corresponding extent by atmospheric air entering through the Y-tube. As the diaphragm is allowed to rise again, the "negative" pressure within the

chamber returns to its previous value and the elastic balloons recoil to their original dimensions.

The bottle shown in the lower left-hand part of the drawing contains fluid upon which pressure can be exerted to cause a steady flow up the tubing into the small oval chamber within the larger one. The oval chamber may be taken to represent the heart; the tubing connecting it with the pressure bottle represents the large veins, and the tubing leading from its right side, the arteries. If the tubing on the left, as well as the upper part of the oval chamber (which corresponds to the auricles) be composed of some thin resilient material, then during the inspiratory reduction in intrathoracic pressure they will undergo expansion (dotted lines). A greater body of fluid will in consequence be transferred from the bottle to the small chamber representing the heart.

The manometer inserted into the wall of the large chamber registers the pressure changes (indicated by dotted lines) occurring during the descent and ascent of the flexible diaphragm.

¹ BEST, C. H., and TAYLOR, N. B.: *The Physiological Basis of Medical Practice*. 3d edition. The Williams and Wilkins Company, Baltimore, Md., 1937, p. 476.

in the basket and immediately tilted 45° head-down, maintaining this tilt until no more water drains from the lungs or stomach. The operator then starts and maintains a rocking rate of 10 to 12 cycles per minute by rhythmically repeating aloud with each head-up and head-down tilt, "In comes the good air" and "Out goes the bad air." After several minutes of operation the tilting angle may be decreased to 30°.

Ventilation, circulation, and time are the *big three* in artificial respiration. Ventilation and circulation must be maintained to insure an adequate supply of oxygenated blood to the vital organs of the body.

The volume of air that can be drawn in or forced out of the lungs depends entirely upon the pressure differences between the atmosphere and lung air induced by changes in thoracic capacity. (Intrathoracic capacity is always subatmospheric, even after death.) An increase in thoracic capacity (inspiration) will further reduce intrathoracic pressure and cause the lungs to expand and a corresponding volume of air to enter the lungs. With a decrease in thoracic capacity, the reverse is true. This may be compared to air being sucked in and forced out as in a bellows (fig. 5). Without active use of the respiratory muscles, changes in capacity of the rib cage by manipulation or force can only be minimal because of its relatively rigid framework. Whereas, the diaphragm can be influenced through a major part of its range of movement by the weight of the abdominal contents. Since the diaphragm has a surface area of 270 square centimeters and average range of movement of 30 millimeters (6) (7) (8), it can be manipulated, theoretically at least, to vary the thoracic capacity by 810 cubic centimeters and cause a corresponding volume of air to enter or leave the lungs.

In the Eve method the weight of the abdominal contents, during the head-up and head-down phases, forces the diaphragm up and down, increasing and decreasing the thoracic capacity in its vertical diameter simulating diaphragmatic or abdominal breathing and causing an adequate exchange of tidal air.

The rocking technique also energizes a weak or failing circulation by stimulating cardiac action, increasing intravascular pressure (blood flow) and facilitating return of venous blood to the right heart. During the head-up or inspiratory phase, the thin walls of the great intrathoracic veins and to some extent the relatively thin walls of the auricles, expand and fill with blood under the "suction" effect of the increase in negative intrathoracic pressure increasing the effective venous pressure and consequently the venous return to the right auricle.

As the body is tilted head-down, the flow of blood along the great veins of the thorax and abdomen is aided by hydrostatic pressure, and by the increase in intrathoracic pressure. (Reduction in negative pressure.)

The rhythmic hydrostatic pressures produced by the alternate head-up and head-down positions, serve to increase the intravascular pressure and consequently the flow of blood along the arteries and veins. Eve cites Hill's experiments in which cerebral circulation was maintained by alternating the head-up and head-down positions (5). This fact assumes major importance when it is realized that if cerebral circulation is stopped the cells of the cerebral cortex will be irreparably damaged within 5 minutes or so and the centers within the brain stem (the respiratory center as well) will succumb within 25 to 35 minutes (9). Hydrostatic pressure also tends to facilitate coronary circulation. During the head-down position the pressure produced by the column of blood in the aorta may serve to close the valves and perfuse arterial blood through the oxygen starved heart muscle via the coronaries.

The removal of wet clothing and the wrapping of the body in warm blankets to conserve body heat as well as the administration of oxygen or any other form of treatment can be accomplished without loss of time or interference with the rhythm of rocking movement.

The physiological advantages of the Eve method have been presented in detail. In addition, it does not require a team of highly trained personnel; one man can operate the machine indefinitely.

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UROLOGIC AND OPHTHALMOLOGIC OBSERVATIONS IN TWO CASES OF REITER'S SYNDROME

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and

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The rare triad of urethritis, conjunctivitis, and arthritis, non-gonorrheal in nature, was first recognized as a clinical entity and described by Reiter (1) in 1916. However, nothing appeared in the American literature until 1942 when Bauer and Engleman (2) reported six cases. The recent war years have added further stimulus to the study of this interesting syndrome due to the fact that the condition occurs only in young adult males and in many cases seems to be related to strenuous activity such as may be encountered in military service.

As yet little is known in a positive sense of the etiology of the syndrome. Indeed, one of the fundamental prerequisites to establishing this diagnosis is the complete absence of evidence of an infecting organism as determined by ordinary laboratory procedures. The term idiopathic blennorrheal arthritis has been suggested by Sargent (3) to escape the use of a proper name in identifying this syndrome.

Two cases of Reiter's syndrome, each presenting somewhat unusual features are here offered in the hope of contributing more information to this interesting problem.

CASE REPORTS

Case 1.—F. W. K., F1C, a rather slight, 19-year-old white male was admitted to this hospital 19 May 1946 stating that for the past 6 weeks he had had a continuous milky urethral discharge. Urethral smears taken at the onset of his complaints were negative for gonococci. However, the patient was given penicillin and sulfadiazine following which his discharge became much worse and he noted marked urinary frequency. Repeated smears were constantly negative, although on one occasion while under treatment elsewhere, he was told that a culture for gonococci was positive. He was again treated with penicillin, in spite of which the discharge persisted.

*Resigned.

On admission to this hospital, the patient's temperature, pulse, respiration, and blood pressure were within normal limits. The physical examination was entirely negative except for a creamy, whitish-yellow urethral discharge and a slightly enlarged, very tender prostate, the fluid from which contained many pus cells with clumps but no organisms demonstrable by stain. The urine was normal except for many pus cells, especially in the first glass. The Kahn was negative and the complete blood count normal. Repeated urethral smears, urethral cultures, and stains of urinary sediment failed to reveal any organisms.

He was treated with daily hot sitz baths and prostatic massages twice weekly. However, 9 days after admission the discharge became more profuse and he complained of a small, well localized area of tenderness in his pendulous urethra. Sulfadiazine, 1 gram four times daily, was given for 3 days. The following day (10 days after admission) he noted aching pain in the medial aspect of his right foot, pain and stiffness in his right shoulder, and pain on chewing in his right temporomandibular joint. At this time several erythematous papules were noted on the plantar surface of each foot. There were also several nontender, flat, insular plaques having a brick red border and central clearing in both buccal mucosae.

The following day the temperature became elevated to 100.4° F. where it remained fluctuating between 99° and 101° for 26 days. On this day also a persistent tachycardia developed with a pulse ranging from 148 in the afternoon to 90 at night, but averaging 100 to 110 beats per minute. This condition persisted for about 41 days. Respirations remained normal.

One day later (12 days after admission) an acute conjunctivitis developed, the discharge from which revealed no organisms by stain or culture. At this time, the blood sedimentation rate was 10 mm. per hour, complete blood count within normal limits, blood urea nitrogen 10.7 mg. per 100 cc., blood nonprotein nitrogen 32 mg. per 100 cc. The urine was loaded with pus cells and showed a trace of albumen. An intravenous pyelogram revealed no pathology.

The symptoms became progressively worse. Three days later the patient was unable to void and an urethral catheter met an obstructing plug of desiccated purulent material at the small limited area of tenderness in the urethra previously described. Within a few days an extremely severe cystitis developed which gradually subsided in about 1 week but this was followed by bilateral epididymitis, more marked on the right. Although the conjunctivitis had cleared by this time the urethral discharge remained profuse and 50,000 Oxford units of penicillin every 3 hours was begun. An x-ray of all the involved joints revealed no pathology, and repeated electrocardiograph studies revealed only right axis deviation and sinus tachycardia with a rate of 130 beats per minute. A blood culture obtained before penicillin was begun was negative. At this stage the pain and tenesmus on urination were so severe as to prevent the patient from emptying his bladder completely. The only relief the patient could obtain was from 4 percent metycaine solution instilled per urethra just prior to voiding.

After having received a total of 1.2 million units of penicillin the patient showed considerable improvement. The epididymitis resolved leaving only a slightly thickened nontender epididymis bilaterally, and subjectively the patient was markedly improved. The cutaneous and oral lesions disappeared, the patient complaining only of frequent and painful erections and tenderness of the right ankle. The blood sedimentation rate remained elevated to 26 mm. per hour, and the urine revealed no red blood cells, 3 to 5 white blood cells, and albumen 4+. A complete x-ray examination of the teeth was negative.

Forty days after admission a rather severe watery diarrhea appeared and persisted for several days. There was also a recurrence of the conjunctivitis

and a slit lamp examination performed by one of the observers revealed early bilateral corneal irritation at the preulcerative stage. The conjunctivitis gradually subsided in 2 weeks, following which the blood sedimentation rate dropped gradually and convalescence proceeded uneventfully. Upon discharge from the hospital 76 days after admission, the patient complained only of slight limitation of motion of the middle finger of the right hand and weakness and instability of both knees.

In a recent personal communication with one of the authors the patient stated he was in excellent health, playing football and basketball, and suffering absolutely no ill effects except for those of a residual low grade chronic prostatitis.

Case 2.—S. T. B., lieutenant commander, a well-developed, well-nourished, white, male, age 30, was admitted to this hospital 17 June 1946 complaining of urethral discharge, inflamed eyes, and a tender and swollen left foot.

Two weeks prior to admission, following a period of strenuous and prolonged sexual activity, the patient noted a urethral discharge. Five days later both eyes became red and irritated. Five days after this the left foot became swollen and too painful to support weight. On the day of admission the right foot became similarly involved.

At the onset of the urethral discharge, urethral and prostatic smears were negative for gonococci. However, the patient stated he was given one injection of 200,000 Oxford units of penicillin in "honey."

The past history was of interest only in that 2½ years previously the patient had had a similar episode with the same sequence of events. This also followed sexual "strain" and differed only in that the foot was only slightly involved. The episode lasted 2 months and sulfa therapy apparently had little effect on its course. Between these two attacks the patient had been free from any signs of urethritis or prostatitis. He denied any past venereal disease.

The physical examination was normal except for the presence of a thick mucopurulent exudate overlying markedly injected conjunctivae bilaterally. There were several small white papules in the buccal mucosa. A thick yellowish urethral discharge was present. The base of the great toe and the dorsum of the left foot were swollen, hot, and tender. The temperature was normal through the day with evening elevations to 100.8.

Laboratory studies on admission revealed the following: Blood cell counts were within normal limits, the urine was normal except for many pus cells in each glass, blood sedimentation rate was 5 mm. per hour, blood uric acid 6.52 mg. per 100 cc., blood Kahn negative, and electrocardiograph studies within normal limits. Repeated stains and cultures of urethral and conjunctival discharges through the course of the disease at no time revealed any organisms. An eye examination by one of the observers (E. J. O.) revealed a subsiding bilateral superficial conjunctivitis which resembled keratoconjunctivitis sicca. Intravenous pyelograms revealed no pathology. X-rays of both feet revealed no bony pathology.

During the first 2 weeks of hospitalization the patient received 40,000 Oxford units of penicillin every 3 hours, sulfadiazine 1 gram four times daily, and sodium salicylate 10 grams three times daily. After 10 days of this, all the symptoms abated somewhat. The blood uric acid was repeated and found to be 5.08 mg. per 100 cc., and colchicine was given for 5 doses without effect.

About 4 weeks after admission a cellulitis with ascending lymphangitis developed over the medial aspect of the right ankle. This was controlled with penicillin and hot wet dressings, and the temperature, which reached 101° F., returned to normal. The penicillin was continued for 3 weeks with no effect upon the urethritis or the conjunctivitis. Because of the slightly elevated blood uric

acid level, neocinchophen was given for 3 days following which the patient developed pruritus and urticaria and all medications including penicillin were discontinued.

A week later (7 weeks after admission) the urethral discharge ceased, the conjunctivitis had disappeared, and the patient complained only of moderate discomfort in his right foot and right knee on walking.

For the next 2 weeks there was little change. Ophthalmologic examination at this time revealed no pathology except definite evidence of decreased lacrimal gland function on the left as shown by filter paper test (Schirmer).

During the remaining 15 weeks the patient received extensive physiotherapy and the symptoms gradually subsided. The blood sedimentation rate returned to normal, repeated foot and knee x-rays revealed no pathology, and after a total hospitalization of 5½ months the patient was discharged complaining only of slight stiffness in his right ankle following exertion.

COMMENT

Two cases have been presented illustrating the triad of urethritis, conjunctivitis, and arthritis in which ordinary bacteriological studies had failed to reveal any evidence of a causative organism. Case 1 was particularly interesting because in addition to this triad the patient developed consecutively a prostatitis, dermatitis of both skin and mucous membranes, persistent tachycardia, clinical evidence of a definite circumscribed urethral lesion, severe cystitis, epididymitis, enteritis, and a pre-ulcerative keratitis. The response of the epididymitis to penicillin suggests it might have been a secondary infection. However, to the authors' minds the multiplicity of the other manifestations is strong evidence of the truly systemic nature of this disease in contrast to the concept of a disease limited to the urethra, conjunctiva, and joints. The case is also of interest because of the complete recovery in spite of the severity of the symptoms.

From an ophthalmologic viewpoint two characteristics were considered of interest in case 1. The first concerned the development of multiple superficial corneal opacities which accepted no more than a slight iridescence with fluorescein stain. This was so faint as to require the use of the slit lamp for its detection despite the fact that the opacities were clearly evident as deep shadows when viewed with the ophthalmoscope held at a distance. There were no posterior corneal opacities or precipitates.

The second item of interest was the great rapidity with which ocular pain subsided following the instillation of pontocaine eyedrops.

In general, the ocular pathology was limited largely to the cornea, conjunctivitis being relatively moderate although greater in the left eye. Vision in the left eye was suppressed to 10/20 during the most acute period but returned to 20/20 as recovery ensued. Gonococcal ophthalmia was felt to have been excluded by the negative bacteriologic cultures and by the relatively rapid regression of the discharge in the absence of concomitant antibiotic treatment.

The corneal lesions had appeared about a week after the discontinuance of penicillin injections and their resolution was noted following the use of vitamins A and D orally and in the form of eyedrops. Studies of lacrimal function were not performed.

Case 2 was of interest as it most probably represented a recurrence, each episode of which followed a period of prolonged and strenuous sexual activity. The ophthalmologic findings were of particular interest, although pathology was confined primarily to conjunctival redness and thickening without obvious involvement of the cornea except for slight dullness. Visual acuity could not be determined accurately at the height of ocular symptomatology because the severity of the arthritis kept the patient bedridden, but rough tests indicated that suppression was minimal in degree.

The course of the conjunctivitis was characterized by the elaboration of ropy mucopurulent shreds in the early stage, followed by progressive disappearance of the discharge as general therapy proceeded. Conjunctival cultures disclosed that hemolytic staphylococci were present in the eyes contemporarily with their presence in the urethral discharge but comparison with other reports returned from the laboratory during this period suggested that these may have occurred merely as contaminants.

Because of equivocal bacteriologic findings in the presence of obvious conjunctival pathology, attention turned toward consideration of the noninfectious conjunctivitides. The Schirmer filter paper test for lacrimal function was performed and the amount of paper wet by the tears after 5 minutes was found as O. D. 20 millimeters, O. S. 5 millimeters. This diminution from the normal in the left eye was compatible with the presence of keratoconjunctivitis sicca.

In studying keratoconjunctivitis sicca, Sjögren (4) had found that it occurred most frequently in patients with *arthritis* who showed deficiency in salivary as well as lacrimal secretions. He had observed atrophic changes in the involved glands themselves and felt inclined to believe that the condition might be the result of a systemic degenerative disease which affected glands and joints concomitantly. It is not intended to suggest that this might be a factor in linking together the component features of the Reiter triad clinically, or as an explanation for the ocular phenomena on the basis of keratoconjunctivitis sicca, but only to note the coincidence in the case under consideration.

The ocular pathology resolved in advance of the other features, leaving no observable sequelae or visual impairment in its wake.

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THE TREATMENT OF WHOOPING COUGH BY ALTITUDE FLIGHT AND LOW PRESSURE CHAMBER

Treatment of whooping cough by staying a few hours at about 8 or 10 thousand feet was already in practice in France before World War II. But this means was possible only for a few privileged people, either owners of a plane or members of aeronautic clubs or air force men. This therapeutic method was used in 1927 at Strasbourg when a whooping cough epidemic was taking place and a pilot of the 2nd fighter regiment had the idea of using it on his son who had a severe case. Some benefit followed.

Medical men became interested and a number of cases were treated by this method. Because of the difficulty of plane flights a low-pressure chamber was substituted and varying times of exposure were given under high altitude pressure. In a period of 18 months about 1,200 children were treated with good results apparently in about 70 percent of the cases.—Abstract from Service d'Information Français, Ottawa, Ont., Canada. No. 432, Lim II, Apr. 14, 1947.

THE Rh FACTOR

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Our understanding of the nature and importance of the Rh factor has increased considerably since its discovery in 1940 (1). It is essential for practitioners in practically every field of medicine to be familiar with the significance of this relatively "new" red blood cell factor. Not only must one's knowledge of the subject be complete enough to satisfy his own needs and curiosity, but it must also be sufficiently adequate to provide a clear and simplified explanation for the concerned and puzzled patient. This report is an attempt to present in a concise and rational manner the present conception of the Rh red blood cell factor and its associated manifestations.

The Rh factor is an agglutininogen with antigenic powers present within or on the surface of the red cells of 85 to 87 percent of the white population. The blood type Rh-positive signifies the presence of the Rh factor, while its absence is designated Rh-negative. In the great majority of instances it is Rh-negative individuals who become sensitized to the Rh factor. This group, about 12 to 15 percent of the white population, is our main concern. (The Rh-negative blood type is much less frequently found in Negroes, Japanese, Chinese, Hawaiians, Filipinos, and American Indians.) Very rarely will sensitization occur in Rh-positive persons.

With the tremendous recent increase in blood transfusion therapy and blood banks, one must understand the significance and importance of the Rh factor. This knowledge is essential if we are to prevent needless catastrophes. The injudicious use of whole blood has resulted in Rh sensitization in far too many cases.

Sensitivity to the Rh factor develops in Rh-negative individuals following either transfusion of Rh-positive blood, or pregnancy in which the fetus is Rh-positive. The number of transfusions or pregnancies necessary to sensitize varies greatly depending mainly upon the antigenic strength of the introduced Rh-positive cells (there are now known to be at least eight Rh subgroups, each probably with different antigenicity) and upon the ability of the recipient to form antibodies. In the majority of instances more than two transfusions have preceded the development of anti-Rh agglutinins. Also, at least

one pregnancy is necessary to sensitize the mother; the infant is very rarely affected in the first pregnancy. Once sensitization has developed it usually persists but the antibody titer may gradually fall over a period of months or years and may disappear entirely. However, if an Rh-negative individual has at any time been sensitized, one can be assured that any subsequent exposure to Rh-positive cells will again result in production of antibodies, probably to a higher titer than that previously produced.

The two major disasters which occur subsequent to development of sensitivity, or iso-immunization to the Rh factor, are erythroblastosis fetalis and intragroup transfusion reactions. (Abortions are not believed to be due to nor caused by sensitization to the Rh factor (2).

Erythroblastosis fetalis or hemolytic disease of the newborn is a disease resulting essentially from hemolysis of the fetal or infant red cells. The outcome of this hemolytic process varies considerably and may be very serious or so mild that no abnormality is suspected. The most serious result is intra-uterine death resulting in a stillbirth. Hydrops fetalis, icterus gravis, and hemolytic anemia are the three commonly observed types in this order of severity. The extent of the fetal damage would seem to depend largely on the titer of the maternal anti-Rh agglutinins but this correlation has not been found true in many instances.

The importance of diagnosing erythroblastosis fetalis must be emphasized due to the very poor prognosis for subsequent pregnancies. In practically every instance in which this condition is present it is now possible to either confirm or rule out the diagnosis.

An Rh-positive infant with an Rh-positive father and an Rh-negative mother is the combination which for all intents and purposes must exist. The infant may present one or more of the following manifestations: anemia, generalized edema or anasarca, increasing jaundice, enlarged spleen and liver, and an increased number of immature red cells in the circulating blood. Of these anemia is the most common. Potter (3) places particular diagnostic importance upon splenomegaly.

Any of the above manifestations may result from processes other than Rh incompatibility. To establish the diagnosis beyond doubt it is necessary to demonstrate anti-Rh antibodies in the maternal blood. With present methods of testing, as will be discussed later, this is possible in more than 90 percent of individuals who are sensitized.

Macerated fetuses, resulting from erythroblastic intra-uterine death are of equal significance. Potter (4) has recently discussed this problem and has listed the following diagnostic criteria: presence of edema, thick protruding tongue, enlarged liver and spleen, normal growth zones at the ends of the long bones to exclude syphilis, enlargement of the placenta often to one-fourth or one-half the weight of the

child, erythroblasts in the placental and pulmonary capillaries, an Rh-negative mother and an Rh-positive father. Potter believes that erythroblastosis can be diagnosed in the macerated fetus by careful gross examination and by finding erythroblasts in the pulmonary capillaries by histologic study.

Theoretically if an Rh-negative mother carries an Rh-positive fetus, fetal red cells containing the Rh antigen will enter the maternal circulation during or at the termination of the pregnancy thereby stimulating the production of anti-Rh agglutinins in the mother (5).

These anti-Rh agglutinins then enter the fetal circulation, as the placenta is known to be permeable to antibodies in general. The hemolytic process follows, resulting in one of the manifestations of erythroblastosis fetalis. Why the above process almost never occurs during a first pregnancy (provided the mother has not previously been transfused with Rh-positive blood) is not known, but several possible explanations may be considered:

(a) Such small amounts of the Rh antigen may gain access to the maternal circulation over a 9-month period that there is not sufficient stimulus to produce a significant antibody titer.

(b) The Rh agglutininogen may not acquire antigenic potency until very late in the course of a pregnancy.

(c) Fetal red cells may not cross the placental barrier to any appreciable extent until delivery, when the greatest disturbance at the placental site occurs, according to Wiener (6). Sensitization would then follow this "transfusion" of the mother with fetal red cells. In substantiation of Wiener's theory maternal agglutinins have often been demonstrated for the first time one to two weeks following delivery.

Regardless of the correct explanation, the first Rh-positive infant born to an Rh-negative mother is very rarely affected. Each succeeding pregnancy, similar in regard to the Rh factor in mother and infant, is much more likely to produce serious fetal or infant hemolysis depending upon the sensitization conferred by the initial pregnancy.

The incidence of erythroblastosis fetalis is much lower than the distribution of the Rh types in the general population would lead us to expect. Approximately 1 out of every 8 marriages is between an Rh-negative woman and an Rh-positive man. In about 1 out of every 10 pregnancies an Rh-positive infant is carried by an Rh-negative mother. Thus, if erythroblastosis fetalis occurred in every pregnancy in which the above Rh combination existed the disease would occur in 10 percent of all pregnancies. Statistically, however, the disease has been found to occur in only about 1 out of every 300 to 400 pregnancies. Fortunately, hemolytic disease of the newborn evidently appears in not more than 1 out of 30 to 40 pregnancies in which theoretical Rh incompatibility exists between the fetal and maternal blood. This

apparent discrepancy may be explained by 1 or more of the following observations:

(a) The more pregnancies a woman has the more likely she is to become sensitized to the Rh factor. The present-day average family is small.

(b) Great variations in the ability of women to form Rh agglutinins are known to exist. Thus some Rh-negative women could have many Rh-positive children and receive multiple transfusions without becoming sensitized.

(c) Some of the Rh subtypes possess very low antigenicity.

(d) In some pregnancies the fetal red cells may not enter the maternal circulation.

(e) Fetal red cells in some instances may not be affected by maternal agglutinins.

(f) The manifestations of the hemolytic process may be so mild that they are not recognized.

(g) Errors in routine Rh typing. False Rh-negative tests are not uncommon and may be the fault of the technician or the typing serum.

The Rh factor is inherited in mendelian manner by a pair of allelic genes, Rh and rh, the former being dominant over the latter. One of these genes is inherited from each parent and thus every individual genetically belongs to one of three groups: RhRh, Rhrh or rhrh. Of these three, the first two groups make up the 85 to 87 percent of the white race which is Rh-positive. Individuals having the make-up RhRh are termed homozygous and if their mate were Rh-negative, their offspring could only be Rh-positive. Those of the Rhrh group are heterozygous—i. e. with an Rh-negative mate, children would have an equal chance of being Rh-positive or Rh-negative. The theoretical possibilities in the simplest form are graphically presented as follows:

Father	Mother	Offspring	
Rh+ Genotype	Rh- Genotype	Rh+ Genotype	Rh- Genotype
RhRh Rhrh	rhrh rhrh	Rhrh (100%) Rhrh (50%)	0 rhrh (50%)

The genetics involved have become much more complicated since the discovery of the several Rh subgroups (7) (8) and the Hr factor but require no further explanation for the purposes of the present discussion.

The Rh factor differs from the A-B factors in several fundamental ways. An understanding of these differences is a great aid in comprehending the complexities of the subject at hand.

An antigen may be defined as any substance which when introduced into the body incites the formation of antibodies. The A and B agglutinogens are antigens present (one or both) in a certain percentage of human blood. Each of these two agglutinogens has its corresponding agglutinin (antibody) which is present in blood not containing the factor or factors (A, B, or AB) with which it would react. Group A blood, for example, contains A agglutinogens and anti-B (b) agglutinins. Transfusion reactions occur due to A-B-O incompatibility when A, B, or AB cells are introduced into blood containing the corresponding agglutinin or agglutinins a, b or a and b. Thus, it might logically be expected that a fetus of a blood group incompatible with that of the mother would often be affected adversely by normally present maternal agglutinins gaining access to the fetal circulation. This catastrophe fortunately, rarely occurs for reasons which will be discussed later.

The Rh factor is likewise an agglutinin with antigenic powers, which is present within or on the surface of the red cells of 85 to 87 percent of the white population. There are several important differences between the AB factors and the Rh factor which should be emphasized:

(a) Neither Rh-positive nor Rh-negative blood normally contains anti-Rh agglutinins; in other words, there are no naturally occurring agglutinins for the Rh factor, as there are for the AB factors. Thus, the first or first few transfusions of Rh-positive blood into an Rh-negative recipient very rarely causes untoward effects provided the bloods are otherwise compatible. The first transfusion, however, often results in a serious reaction if AB incompatibility exists since anti-A and anti-B agglutinins are normally present in human blood.

(b) An important difference between the Rh and the AB factors is the temperature in which these factors react *in vitro* with their specific agglutinin or antibody. The AB agglutination reaction occurs readily at usual room temperature as observed in the ordinary cross-matching tests. Agglutinins for the Rh factor, however, require body temperatures approximating 37° C. in order to agglutinate Rh-positive cells *in vitro*. Obviously then, somewhat special laboratory techniques must be used in determining the presence or absence of the Rh factor and anti-Rh agglutinins.

(c) There has been recent evidence to show that the anti-Rh antibody formed often is of a different type than the agglutinin for the AB factors. Wiener (7) (9) believes this antibody acts in such a way that it blocks agglutination of the red cells in *in vitro* testing and yet causes equally destructive *in vivo* hemolysis. This anti-Rh blocking antibody appears to be responsible for many of the serious complications resulting from sensitization to the Rh factor. According to

Wiener's theory (6) (7) blocking antibodies cross the placental barrier much more easily than do the AB agglutinins thus explaining why anti-Rh antibodies are so much more dangerous to the fetus than are the AB agglutinins.

(d) Certain individuals possess A or B agglutinogens not only in their red blood cells but also in tissue cells throughout their bodies. Such individuals are termed "secretors." These secretor substances, or tissue agglutinogens, act to protect the red cells containing the same or similar agglutinogens by neutralizing agglutinins, which are not introduced rapidly into the blood, before they can destroy the essential circulating red cells (10). A certain number of infants probably are protected from maternal AB agglutinins by such a mechanism. Unfortunately, there is no such protection offered when dealing with the Rh factor and no Rh secretor substances are known to exist.

In approximately 90 percent of the cases of congenital hemolytic disease, the mother is Rh-negative and the infant Rh-positive (10). The remaining 10 percent occur as a result of sensitization to one of the Rh subtypes, the A-B-O factors, or the Hr factor. In these instances the mother is Rh-positive, group A, B, or O, and the infant Rh-negative, Rh-positive but with a different Rh subtype, or group B, A, or AB, respectively. Although cases falling within this latter group are rarely encountered, it should be emphasized that the diagnosis of erythroblastosis cannot be ruled out, without further testing, when the mother is found to be Rh-positive.

An explanation should be given at this point concerning the significance of the Hr factor. This antigen is present in the blood of about 70 to 80 percent of *Rh-negative* persons and may be responsible for erythroblastosis by an analogous process of iso-immunization. Anti-Hr serum, obtained from individuals who have become sensitized to the Hr factor, is of limited but definite value. The reactions of this antiserum determine whether certain Rh-positive fathers are homozygous (genotype RhRh) or heterozygous (genotype Rhrh) (7). This information is obviously of great prognostic aid regarding the outcome of future pregnancies.

There is no specific treatment for erythroblastosis as such. Our only means of combating the hemolytic anemia is by blood transfusion, which, however, often is lifesaving. Most investigators are of the opinion that Rh-negative blood is superior since it is known that Rh-negative cells will survive hemolysis. Davis and associates (11) have recently advocated the use of Rh-positive blood. Supposedly Rh-positive cells will, to a varying extent, be hemolyzed and in doing so will more rapidly use up the anti-Rh agglutinins in the infant's circulation. The infant's own red cells would then be more likely to be spared. Physiologically, such a procedure would seem to be adding

insult to injury. By thus increasing the break-down products of hemoglobin to be excreted, the already overburdened kidneys and liver would have an increased load to carry.

If Rh-negative blood is not available, washed maternal red cells may be used without danger. Rh-positive blood is certainly to be given rather than none.

Recent developments in testing for the presence of anti-Rh agglutinins have made it possible to detect them in almost all of the cases in which sensitivity exists. Three *in vitro* agglutination tests have been described which have proved to be not only technically simple but also very accurate. The Rh blocking antibody and the conglutination tests were first described by Wiener (9), (12). Diamond and Abelson developed the slide agglutination test (13). The patient's serum and a source of fresh group O Rh-positive cells are the only requirements necessary for carrying out these procedures. No further discussion is necessary in this report; detailed outlines of the laboratory procedures are readily available in the literature (7) (9) (12) (13) (14).

There is at present no known procedure which will prevent the occurrence of hemolytic disease of the newborn once maternal sensitization has developed. Cesarean section and induction of labor before term have not proven to be the answer; the hemolytic process is not apparently prevented and the risks and dangers of prematurity are added. Wiener has postulated that, by introducing a better antigen than the Rh factor, the antigenicity of this factor might be repressed to such an extent that antibodies for it would not develop (Competition of Antigens Theory) (15). One such case has been reported in which the injection of pertussis and typhoid vaccines at intervals during pregnancy evidently prevented Rh sensitization (16). Our efforts in the future must be directed toward some method of maternal desensitization, as prophylaxis now consists entirely of avoidance of sensitizing transfusions.

Ideally, every individual should be Rh typed before receiving a transfusion and if negative should receive only Rh-negative blood. It is not necessary, however, to follow this procedure in certain instances such as a single transfusion for a man or for a woman past the child-bearing age who has never been pregnant nor transfused. Rh-negative individuals included in the following groups should only receive Rh-negative blood: (a) men who are expected to require many transfusions; (b) all women before or during the childbearing period; (c) women who have had one or more children or have been previously transfused, regardless of their age. Only by taking these precautions can serious and perhaps fatal transfusion reactions or inso-immunization to the Rh factor be prevented.

Adequate prenatal care should include the Rh typing of every expectant mother. The husbands of all who are Rh-negative should also be typed. Rh-negative mothers who have had one or more Rh-positive children should be tested for the presence of Rh agglutinins. By detecting the presence of Rh factor sensitivity before delivery a supply of Rh-negative blood can be made available for the infant. A certain number of erythroblastotic infants may be saved by the transfusion of Rh-negative blood which is not always immediately available unless obtained in advance.

A pregnant Rh-negative woman, with an Rh-positive husband, who has had a previous pregnancy result in an erythroblastotic infant offers a difficult prognostic problem. The paternal genotype here becomes of the utmost importance. If the husband is heterozygous (Rhrh) the infant would have a 50 percent chance of being Rh-positive and almost certainly affected, probably more extensively than the first such child. Any other living children should be Rh tested as the first step. If any of these are found to be Rh-negative, the paternal genotype could only be Rhrh, as explained previously. If there are no living children, or the children tested are Rh-positive, the father may be tested for the Hr factor. The homozygosity of a certain number of Rh-positive individuals can be determined in this manner.

SUMMARY AND CONCLUSIONS

1. The clinical significance of the Rh factor and its related phenomena has been thoroughly substantiated in the past 6 years.
2. Intragroup transfusion reactions and erythroblastosis fetalis are the two disasters which result from sensitization.
3. Erythroblastosis fetalis occurs about once in 30 to 40 instances where theoretical Rh incompatibility exists.
4. Sensitization resulting from blood transfusion can be prevented if proper precautions are taken.
5. There is no known method of preventing sensitization as a consequence of pregnancy.
6. A considerable number of affected infants can be saved by the prompt transfusion of Rh-negative blood.
7. Rh sensitivity can be demonstrated in almost all instances in which it exists.
8. The prognosis for future pregnancies subsequent to sensitization is poor. The outcome of such pregnancies can often be predicted.
9. The goal of future investigation should be a practical and effective method of maternal desensitization.

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THE BANKART OPERATION FOR RECURRENT DISLOCATION OF THE SHOULDER

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The subject of chronic recurrent dislocation of the shoulder is particularly important to the Navy because it is a disability arising from injury which occurs among active young males. Almost always the original injury is one of violence such as a "fall downstairs with sea bag on the shoulder," a football injury, a fall from a tree, or a vehicle accident. Usually postreduction immobilization is not maintained long enough for the capsule to heal, and subsequent dislocations recur often with little violence.

The shoulder joint is a ball and socket enclosed in a strong capsular ligament. The humeral head and the glenoid cavity are covered with hyalin cartilage. Around the edge of the glenoid is a ring of fibrocartilage, called the glenoid labrum which deepens the fossa and serves to unite the capsular ligament to the osseous glenoid. The capsule is surrounded by the rotator muscle attachments and the strong external chest, shoulder, and back muscles.

When the arm is abducted and externally rotated the head of the humerus is brought into a position where the joint capsule is relatively weak. When this motion is executed violently the head of the humerus is levered over the glenoid rim detaching the labrum and capsular attachment and frequently producing a chip fracture of the osseous rim of the glenoid. This is the essential pathology of a dislocated shoulder.

Nerve and vascular lesions are infrequent. Concurrent acromioclavicular injury greatly increases the disability. Arthritic changes sometimes follow repeated traumata.

Many operations have been proposed to remedy this condition. Of these Nicola's operation, which strings the head of the humerus on the tendon of the long head of the biceps, has been most popular. Steindler¹ quotes satisfactory results in 95 percent of the cases operated upon by this method. This operation is attended by practically

¹ STEINDLER, A.: *Orthopedic Operations*. Charles C Thomas, Publisher, Springfield, Ill., 1940. p. 158.

no limitation of motion and a relatively short convalescence, but in our military experience it has been accompanied by a high percent of recurrence. One of my own cases recurred during an unofficial wrestling bout before he had been discharged from the hospital.

The Bankhart operation seeks to prevent recurrence of dislocation by attacking fundamental pathology, which is the detachment of the capsule and glenoid labrum from the anterior-inferior aspect of the glenoid. An incision is made over the coracoid process from the clavicle to the deltoid insertion. After separating and retracting the deltoid and pectoralis major the coracoid is exposed. The tip of the coracoid holding the origins of the short head of the biceps and the

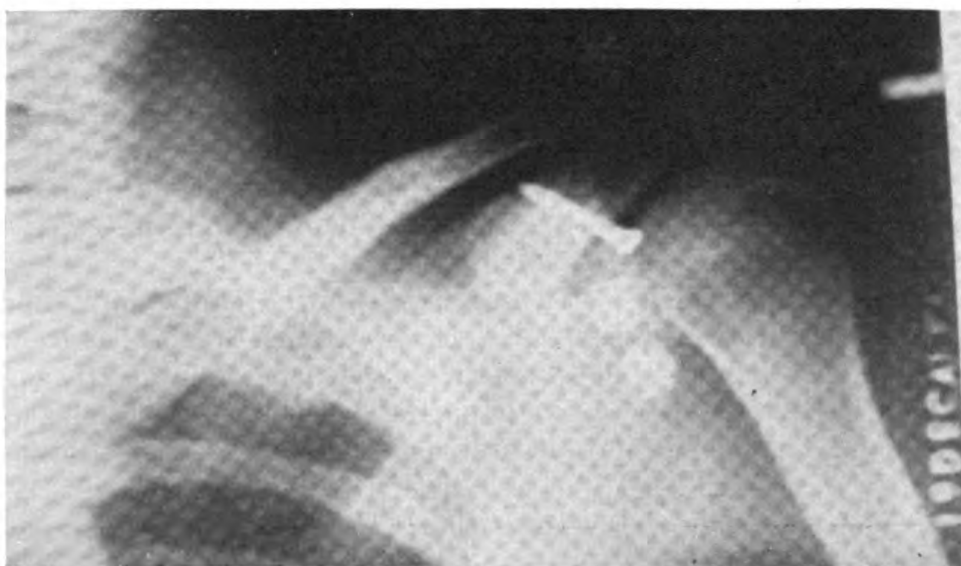


FIGURE 1.—Typical internal fixation.

coracobrachialis is removed with an osteotome in order to medially retract the muscular flap thus freed. The tendon of the subscapularis thereby exposed is divided and reflected medially to expose the anterior-inferior aspect of the shoulder capsule.

The detached glenoid labrum, which is found uniformly, and the frequently found chip of bone are excised and discarded. The glenoid rim is then cleaned to bare bleeding bone with chisel and curet and all fragments seen are removed from the joint. Bankart originally described the reattachment of the capsule with fine wire mattress sutures through drill holes in the glenoid rim, or by the use of small staples. Without a special angle drill of small size much time and trauma can accrue in making the holes. Here we have been utilizing a single screw and one hole plate used as an upholstering tack to re-

attach the capsule. The vitallium screw and plate are favored for this use because of its smaller size and smoother contour.

Cotton suture is used for the repair of the subscapularis and other soft tissue. The coracoid is reattached with another screw of the same metal. A well-padded Velpeau bandage of 8-inch stockinet rolled over heavy pads is placed over pressure points and is maintained for 1 month.

For anesthesia, metycaine 1 percent and adrenalin have been used combined with supplementary pentothal sodium. In several cases no pentothal has been required. In no case has very much pentothal been necessary. Postoperatively carbon dioxide has been given routinely following one case of compression atelectasis. Dermatitis and mild pressure sores have been the only other complications.

This series of eight cases was undertaken for evaluation of the operation because of the frequent recurrence following Nicola's operation when the shoulder was subjected to full active use. In all cases these active young men desired a complete cure for their dislocation so that they could return to active athletic sports without fear of recurrence. In no case did the patient desire an operation which would enable him to perform only limited activity.

This procedure has been criticized because of the marked limitation of motion which sometimes occurs, however, some motion has to be sacrificed for stability. Local anesthesia with adrenalin greatly improves the hemostasis, visibility of operative field, and lessens operating time. The old dictum that "the more bloody and traumatic the



FIGURE 2.—Only one case out of seven shows unacceptable range of motion after Bankart operation.

more likely for success" does not have to be followed. Accurate approximation of tissue in a relatively bloodless field lessens subsequent fibrosis and consequent restriction in motion.

After immobilization for 1 month during which time the Velpeau has been changed for removal of sutures and for skin hygiene, the shoulder and elbow are quite stiff. Active motion and physiotherapy are instituted and soon improvement occurs in most cases. A review of the case of a poor result frequently shows the presence of concurrent disability which was not adequately evaluated. In one case from this series a concurrent acromioclavicular injury with calcification of the coracoclavicular ligament was present preoperatively. Subsequently, associated with marked limitation of motion, an erosion of the humeral head has appeared on X-ray examination. In another case a previously stiff elbow was difficult to mobilize postoperatively, but for the average case mobilization has not been difficult.

TABLE 1.—*Case reports*

Case	Injury	Time lapsed— injury to op- eration	Num- ber of dis- loca- tions	Sed. rate	Concurrent injury	Operating time	Result
		<i>Months</i>				<i>hr. min.</i>	
M, 19 years old...	Fall.....	12	50(?)	4	Stiff elbow from pre- vious injury.	2 45	Good.
H, 19 years old...	Fall down ladder..	12	10	7	Acromioclavicular sep- aration.	2 00	Poor.
H, 20 years old...	Jeep accident.....	8	6	9	None.....	2 00	Fair.
B, 19 years old...	Football.....	25	15	3	Erosion of humeral head.	2 20	Good.
R, 18 years old...	do.....	18	10	8	None.....	2 00	Do.
E, 18 years old...	Fall while running	8	5	3	do.....	2 00	Do.
B, 31 years old...	Fall down ladder with sea bag.	24	25	10	Erosion of humeral head.	1 52	Do.
W, 19 years old...	Wrestling.....	34	50	6	None.....	2 20	Do.

After observing a small series of eight cases (table 1) it is concluded that the Bankart operation offers a cure for chronic recurrent dislocation of the shoulder with a negligible recurrence rate and maximum stability. Some limitation of motion must be expected. In selected cases it offers a high percentage of good functional results. Concurrent shoulder injuries or evidence of arthritic changes are considered contraindications. Older people, or those not requiring complete stability for active sports will probably get a better functional result from Nicola's operation.

PSYCHIATRIC SCREENING TESTS AT A PRECOMMISSIONING CENTER

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The problem of the construction and use of mass screening devices to aid in the detection of those men unfit for military service by reason of psychological inadequacy or psychiatric deviation has been the subject of frequent report. In most instances, however, these reports have dealt with findings on men at the recruit or induction stage, and the various tests have been standardized and validated on this preservice or early service population.

While it is true that the need for mass devices is not so pressing at present, it is felt that the findings from the present study, which was made in an attempt to test whether the screening techniques found so useful at the early service level continued to have validity and selective power when used with subjects having had longer, arduous, and dangerous duty, are of interest historically and have definite implications for the continuation of screening methods. The man who has "shipped over" for immature and impulsive reasons (often solely to obtain the 30-day leave), the man who has re-enlisted because the anxiety created in the attempt to readjust to civilian life was too great, and the "Regular" whose motivation has deteriorated with peace are instances in point, and are not infrequent in the author's experience.

With the change in function at this particular station from a "Boot" training center with men arriving into service directly from civilian life to a precommissioning center where all arriving for assignment had completed recruit training and the majority had already had sea duty, including combat experience, the psychiatric screening program had to be geared to detect not only those "missed" by previous examinations but also those in whom some deviation had developed during or because of their service. Because of the limitation of personnel the utilization of some sort of screening device to detect the men requiring more extensive psychiatric attention was imperative. The two screening devices in use at this station during the recruit-training days, the Cornell Selectee Index,¹ and the Naval Personal Inventory No. 2, had proved of great value in the detection of the unfit and the

¹ A 32-item abbreviation of the C. S. I., Form N, including the 15 "stop" questions was used.

misfit, and it was decided to continue these tests with the longer service group. Accordingly, all men coming to this station for assignment, with the exception of those coming directly from initial recruit training, were given these two tests as a part of their initial processing upon arrival. Those achieving scores in the critical ranges were subject to psychiatric interview from which the man might be sent on to unrestricted duty, noted for subsequent check, or admitted to the neuropsychiatric unit for further study. Other sources of admission to the neuropsychiatric unit were by way of consultation after referral from dispensaries and administrative offices.

In this survey the results from these 2 screening tests are compared for 2 groups. The control group is comprised of 1,936 men arriving at this station in the early months of 1945. From this group are excluded several processing groups (men are formed in groups of 60 for processing) known to be made up exclusively of men reporting to this station following a "survivor's leave," and of men known to have been transferred from their previous assignment because of unsatisfactory service. The primary consideration for inclusion in the control group was that, in a period of 3 months following their arrival on this station, none of these men had been admitted to the neuropsychiatric unit. The other group consisted of 206 men who had been admitted to the neuropsychiatric unit during the same period, with the only selection criterion being the availability of the original screening test blanks. Of this particular group approximately 5 percent had been admitted to the neuropsychiatric unit directly from the screening examination, and approximately 25 percent as the result of subsequent psychiatric re-check. The majority of the remainder were referred to the unit from dispensaries, either as a "first contact" or prior to the time for being called for checking. A small percentage were referred from chaplains' and administrative officers. Only 17, or 8.2 percent, of this group were restored to duty—all of the others were either separated from the service or transferred to a naval hospital as in need of treatment or prolonged observation.

Figure 1 shows the percentage distribution of scores for the Personal Inventory for both the control and admission groups.

Inspection of the statistics underlying these curves reveals that the average score for the control group was 5.05, while the mean score for the admission group was 11.36, and that only 10 percent of the control group equaled or exceeded a Personal Inventory score of 11, where 64 percent of the admitted group reached or exceeded this score.

Here the question of "cutting score" arises. Choice of a particular score as critical must of necessity be a function of the time and person-

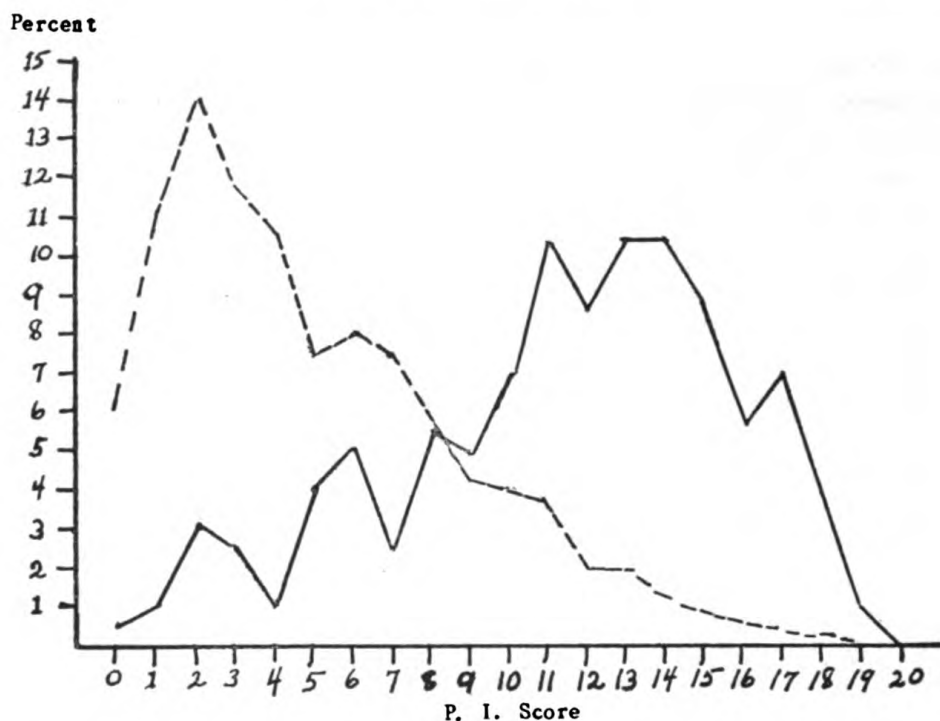


FIGURE 1.—Distribution of personal inventory score. Solid lines, men admitted to N. P. unit (206) ; broken lines, men never admitted to N. P. unit (1936).

nel available. Table 1 shows the cumulative percentages for the various possible scores occurring in the two groups.

TABLE 1

Score on personal inventory	Admits	Nonadmits	Score on personal inventory	Admits	Nonadmits
	<i>Percent</i>	<i>Percent</i>		<i>Percent</i>	<i>Percent</i>
19.....	0.9	0	9 or greater.....	75.9	18.3
18 or greater.....	4.7	.1	8 or greater.....	81.2	23.8
17 or greater.....	11.0	.4	7 or greater.....	83.6	31.2
16 or greater.....	16.3	.8	6 or greater.....	88.4	39.0
15 or greater.....	25.0	1.5	5 or greater.....	92.2	46.5
14 or greater.....	35.1	2.6	4 or greater.....	93.1	57.2
13 or greater.....	45.1	4.5	3 or greater.....	95.5	68.9
12 or greater.....	53.3	6.5	2 or greater.....	98.4	82.9
11 or greater.....	64.4	10.1	1 or greater.....	99.3	94.1
10 or greater.....	71.1	14.1	0 or greater.....	100.0	100.0

Setting the "cutting score" too low places an undue burden on limited interviewing personnel—a critical score that is too high results in too many "misses," and while it has been the experience of the author that a goodly share of "misses" reach psychiatric attention by way of other sources, too great laxity in this respect is reflected in morale factors

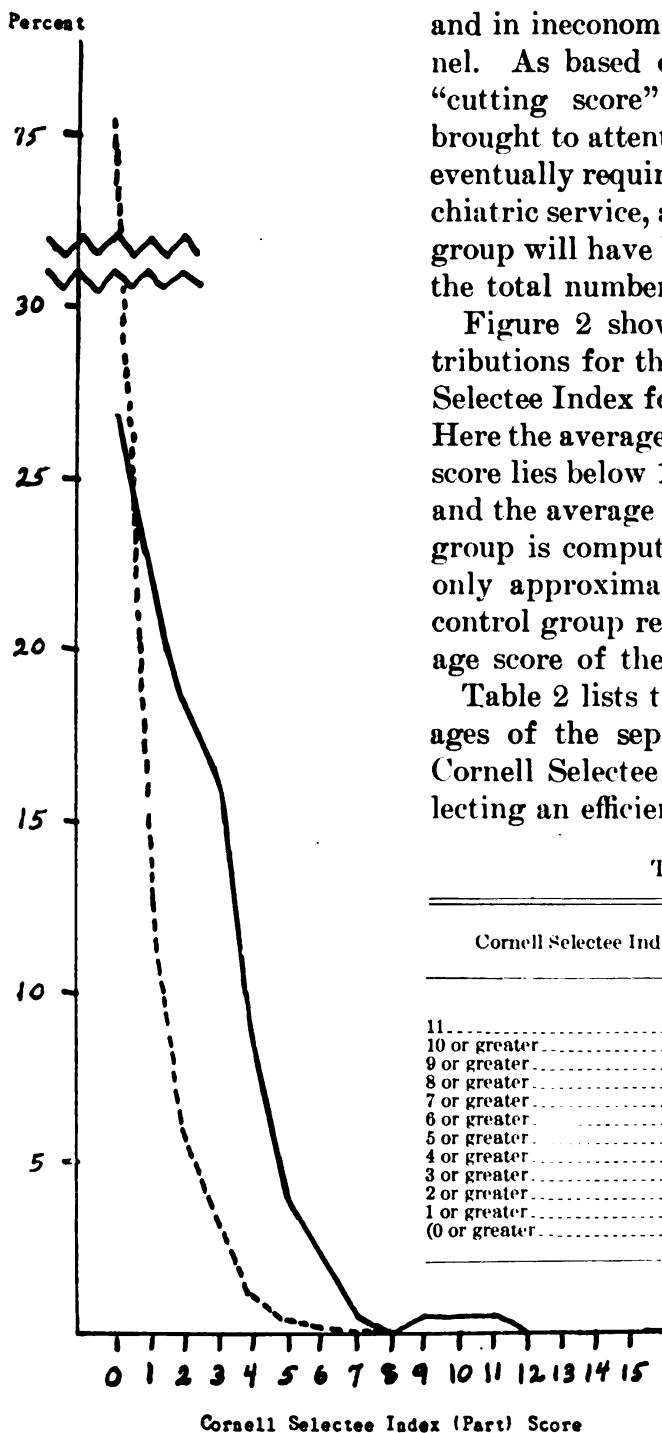


FIGURE 2.—Distribution of Cornell Selectee Index (stop) scores. Solid lines, men admitted to N. P. unit (206); broken lines, men never admitted to N. P. unit (1,936).

about the interviewing of 24 percent of the group being processed as “false positives.”

and in ineconomies of time and personnel. As based on the above figures a “cutting score” set at 9 will have brought to attention 75 percent of those eventually requiring admission to a psychiatric service, and the “false positive” group will have been only 18 percent of the total number being processed.

Figure 2 shows the percentage distributions for the scores on the Cornell Selectee Index for the same two groups. Here the average Cornell Selectee Index score lies below 1 for the control group, and the average score for the admission group is computed at 1.9. Once again only approximately 10 percent of the control group reach or exceed the average score of the admission group.

Table 2 lists the cumulative percentages of the separate scores from the Cornell Selectee Index as an aid to selecting an efficient critical score.

TABLE 2

Cornell Selectee Index score	Admits	Non-admits
	Percent	Percent
11.....	0.4	0
10 or greater.....	.8	0
9 or greater.....	1.2	0
8 or greater.....	1.2	.1
7 or greater.....	1.6	.1
6 or greater.....	4.0	.2
5 or greater.....	7.8	.4
4 or greater.....	16.0	1.3
3 or greater.....	32.5	4.6
2 or greater.....	50.9	10.5
1 or greater.....	72.7	24.6
(0 or greater.....	100.0	100.0)

Thus, a critical score of 1 on the Cornell Selectee Index would be expected to cover 72 percent of the eventual admissions, while bringing

It has been the experience of the author that "false positives" occur more frequently with the Selectee Index than is the case with the Personal Inventory. This may be partially due to the all-or-none wording of some of the Index items, and to the apparent tendency for some of the items to lend themselves to habitual misinterpretation. For example, the man who had nonepileptic convulsions in infancy, the man who detected fleeting traces of blood in seasickness vomitus, the conscientious man who received three parking tickets, and the man who in haste does not notice the word "mental" preceding "hospital" on the test blank, consistently swell the "false positive" group because of their affirmative responses. It has been our practice because of this effect to control the testing situation as closely as possible, with the identical instructions, designed to minimize this tendency, given to each group.

Since many of the "noncritical" items of the Cornell Selectee Index have to do with anxiety state and related symptoms, and since so many of the men in this study had been through dangerous and strenuous duty, it was considered advisable to determine the distribution of scores for the entire Cornell Selectee Index scale rather than for only those items originally regarded as significant. Figure 3 gives this distribution, and a marked differentiation is again apparent. Cumulative percentage analysis indicates that 80 percent of the admission group reached or exceeded a total score of 6 points as against 18 percent of the control group.

Because of the wide range in the percentages of the two groups responding significantly to the various items of the two tests it seemed advisable to make an item analysis with a view to identify those items offering the greater differentiating power. Accordingly, the frequencies of significant responses for all the items of both scales were subjected to Chi Square testing. It was found that the differences in the percentages giving "abnormal" responses between the admission group and the control group failed of significance at the 1 percent level in the case of 3 items only—No. 7 of the Personal Inventory, and Nos. 16 and 30 of the Selectee Index.

The most useful items are obviously those responded to significantly by a heavy proportion of the admitted group, and at the same time by relatively few of the control group. On the Personal Inventory scale 16 of the items received significant response from over 50 percent of the admission group. In all but 4 of these items the percentage of admitted cases responding significantly exceeded the corresponding percentage of significant responses in the control group at a ratio of 2 or greater to 1. The four items where this ratio was smaller than 2 to 1 are items 1, 4, 14, and 17. The items where fewer than 50 percent of the admitted group responded significantly were Nos. 2, 5, 7 (where

the difference between admissions and controls is not real), and 12. Except for No. 7, the ratio for these items as between admissions and controls is better than 2 to 1. Thus, a revision of this scale eliminating the 8 items just mentioned would be expected to possess ample differentiating power.

In respect to the Cornell Selectee Index scale, the proportion of items satisfying the criterion of occurrence of significant responses in over 50 percent of the admission cases, and a minimal ratio of 2 to 1 frequency over the control group occurrence is smaller. Only 9 items meet this requirement. These are Nos. 1, 2, 6, 7, 8, 9, 19, 20, and 23. It is noted in passing that 7 of these items are among those items considered noncritical in the original standardization. Items 16 and 30 do not differentiate between the 2 groups. Of the remaining items the ratio in the direction of more frequent occurrence in the admission group is 2 to 1 or greater except in the case of No. 4. However, the percentage of occurrence in many of these items is small—less than 10 percent in 10 of them. Such items might economically be eliminated on the basis of infrequency, particularly in the light of the author's experience that the

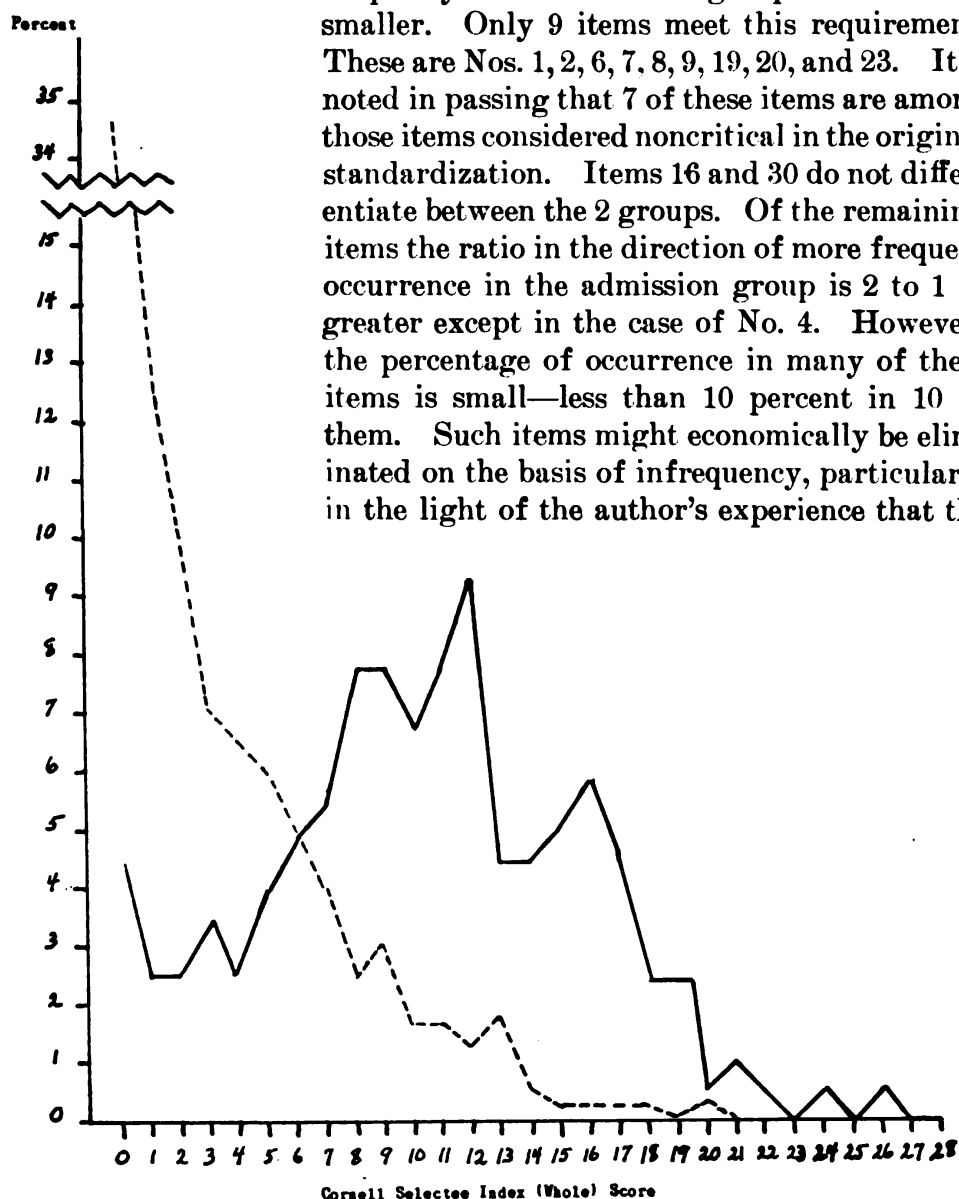


FIGURE 3.—Distribution of Cornell Selectee Index (whole) scores. Solid lines, men admitted to N. P. unit (206); broken lines, men never admitted to N. P. unit (490).

categorical nature of the significance of those items is open to question; otherwise they should be modified to enhance their categorical value. There is no question but that at the recruit level or induction level these items in question are of greater importance.

In summary, then, it has been the experience of the author that both the Personal Inventory and the Cornell Selectee Index, used as preliminary screening instruments to select men who should come to psychiatric attention, are valuable aids, particularly when time and personnel are limited, and that furthermore these tests show a differentiating power when used with the long-service group which is comparable to that found when dealing with men at the induction level. Of the two tests the Personal Inventory seems to offer better results. Its items are shown to contain a greater proportion of those with heavily selective power, and fewer "false positives" result from its use. Against these factors is one point where the Cornell Selectee Index has the advantage in that the Cornell Selectee Index samples a wider variety of symptom complexes, but the true occurrence of some of these at the long-service level is so rare as to make this advantage largely academic.



INFLUENCE OF SULFUR-CONTAINING AMINO ACIDS (METHIONINE, CYSTINE, AND CYSTEINE) ON THE COURSE OF EXPERIMENTAL HYPERTHYROIDISM

"In rats, large doses of thyroid hormone disturb the functioning of many organs and particularly affect the liver and adrenals. Administration of cystine or cysteine and especially methionine checks the loss of glycogen from the liver and loss of cholesterol from the adrenals, provoked by thyroid hormone, but does not diminish the loss of creatine from the heart and skeletal muscles. Much discussion."—ABELIN, I. (Univ. Bern): *Helv. Physiol. Pharmacol. Acta* 3: 481-95 (1945) (in German). *Chemical Abstracts* 40: No. 10, p. 2894, May 20, 1946.

OSTEOPLASTIC REPAIR OF DEFECTS OF THE TIBIA FOLLOWING OSTEOMYELITIS DUE TO TRAUMA

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and

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One of the serious problems arising in the handling of war wounds is the late treatment of osteomyelitic defects of the bone. According to Veterans' Administration statistics of World War I, there were 22,954 compound fractures on the records from 1919 to 1926. Four thousand and fifty-three (17.6 percent) of these were complicated by osteomyelitis and 4,244 (18.5 percent) were being compensated on the basis of total disability.

In World War II the problem has been enormously magnified by the fourfold increase in total casualties. Also, due to the use of the sulfonamides, penicillin, whole blood and plasma as well as the standardized employment of the Orr-Trueta closed plaster treatment of wounds of the extremities, more patients with severe type injuries survived and required definitive treatment.

Many methods have been advocated for the elimination of the infective process in these cases. They include extreme "saucerization" operations followed by primary or secondary closure of soft parts, bone grafts followed by primary closure, and the utilization of viable flaps of muscle swung over from adjacent areas to fill the defect.

During World War II a method was used both in the British forces and our own for the early definitive treatment of chronic osteomyelitic processes in bone that led to eradication of the infection and closure of the site. It was, in effect, a three-stage operation. In the first stage, the infected area was removed surgically as well as possible, all visible dead bone and debris being cleaned out and the overhanging edges of the cavity chipped away. The surgical cavity was then packed lightly with gauze impregnated with vaseline and the extremity placed in plaster of paris until all signs of the active infective process had disappeared. The second stage was then at-

tempted in which a split skin graft was inserted into the defect. This converted the open infected wound into a closed wound. It served as a stimulant to the growth of granulation tissue and acted as an indicator for the continued presence of infection. In the third stage the split-skin graft was removed, the defect again cleaned out down to viable bone and the cavity filled with bone chips from some other sources. Healthy skin was then mobilized from the surrounding area to cover the defect, which was closed without drainage.

It seemed to the authors that this procedure had certain drawbacks. In the first place it was quite long, requiring three separate operations. Second, a great deal of judgment was required on the part of the operator to determine when the patient was ready for the second and third stages. Once the cavity was tightly closed there was no room for error.

To overcome these difficulties a two-stage operation which did not envisage the complete closure of the original infected cavity until drainage had ceased was devised. It employed the antibiotic penicillin, locally as well as systemically. Use was also made of the sulfonamides locally and by mouth.

All of the cases were in the tibia, usually the upper third, but the method should be applicable equally to the femur.

PROCEDURE

When the patient is afebrile and in suitable general condition for surgery, x-rays and photographs are taken of the area involved. He is given a course of penicillin injections, 50,000 units every 3 hours for 2 days. Sulfathiazole is administered by mouth in the usual doses. The visible defect in the tibia varies in size from a pinhole to an opening several centimeters in diameter. It is filled with granulation tissue and necrotic fragments of bone and the lining may be partially epithelialized. Usually there is a seropurulent drainage and the edges of the sinus are red, shiny, and adherent to the underlying bone.

In the first stage of the procedure an incision is made in the long axis of the leg, including the sinus opening and extending down to bone. The adherent soft parts are dissected from the edges of the bony cavity. The cavity is then cleaned of its granulation tissue and any sequestra and debris that may be present removed. Overhanging edges are cut away and the defect made as shallow as possible. It is then filled with gauze impregnated with vaseline and a light cast applied from toes to mid thigh. The penicillin is continued until the patient has passed 48 hours without a rise in temperature. The wound is not disturbed except at 10-day intervals when an examination is made to determine the proper time for the next stage.

Usually the second and last stage can be performed 2 to 3 weeks later. At that time the cavity is again thoroughly debrided. The medullary cavities leading into the defect from both sides are opened. The defect is filled with cancellous bone chips taken from the iliac crest through a "trapdoor" raised in that bone below and lateral to the anterior superior spine. The skin over the tibia is mobilized and drawn over the defect, being closed tightly with interrupted vertical mattress sutures of nonabsorbable material. This skin must be healthy, all scarred areas being excised. It must be closed also without tension. To effect the closure it is usually necessary to make relaxing incisions in the long axis of the leg on the lateral or medial sides. A stab wound is made at the most dependent portion of this relaxing incision into the base of the cavity filled with bone chips. A rubber tissue drain is inserted through this opening and secured by one suture. We feel that this drain is a very important part of the procedure. One of the most common causes of the breakdown of the skin closure without drainage is the early pressure on the suture line of blood and exudate following the operation. The saturated dressings at the first change of plaster testify to the amount of this hemorrhage.

It is then sometimes possible to close the relaxing incision primarily. If this cannot be done, a split-skin graft is lifted from the anterior surface of the thigh and placed to cover the defect.

The wounds are then covered with gauze impregnated with vaseline, gauze fluffs, and sheet wadding. The leg is immobilized in a plaster of paris posterior splint applied from the toes to midhigh. At the end of 5 days the rubber tissue drain is removed. Sometimes it must stay longer. In the case cited in this article when the drain was removed in 5 days the area above and around the bone chips quickly filled with exudate and alarming pressure was made on the suture line. A No. 12 soft rubber catheter is inserted into the tract of the drain. Through this catheter, which is incorporated into the dressing, the cavity is irrigated twice daily with 100,000 units of penicillin in 10 cc. of solution. The patient receives 30,000 units of penicillin parenterally every 3 hours at the same time.

The use of penicillin locally is continued as long as the surgeon deems necessary. Adequate blood levels of one of the sulfonamides are maintained at the same time. In this series the skin closure over the original defect was firm and hard in an average of 10 days following the insertion of the catheter or 15 days following operation. After the catheter was removed the small resulting sinus usually closed in 48 hours. In no instance did it remain open more than 1 week and a permanent sinus has never resulted.

Six cases have been treated in this fashion without failure. One of these will be presented as being illustrative and detailing some of the difficulties encountered.

CASE REPORT

T. J. D., colonel USMC, 29-year-old white American male wounded in action by mortar fire 12 March 1945. He suffered a severe soft tissue injury to the left thigh which severed the sciatic nerve, a compound, comminuted fracture of the proximal end of the left tibia, and a less severe fracture of the same bone at the junction of the middle and lower thirds. He was given supportive treatment, including 5 pints of whole blood. His wounds were debrided and sulfanilamide crystals instilled. They were packed lightly with gauze impregnated with vaseline and the extremity encased in plaster. He spent some time at a base hospital in the Pacific and finally arrived at San Diego in early October.

At that time he had an opening the size of a 25-cent piece in the anterior aspect of the left tibia 3 centimeters below the knee joint. This was epithelialized and discharged a thin serous material. There was a granulating wound 4 cm. by 2 cm. on the anterior aspect of the same leg at the junction of the middle and lower third of the tibia.

He was given a course of penicillin consisting of 30,000 units every 3 hours for 5 days before operation. His temperature being normal and blood picture satisfactory he was operated upon 24 October under pentothal anesthesia. The lower wound was "saucerized," all necrotic bone fragments removed and packed lightly with gauze impregnated with vaseline. No other treatment was afforded this lesion and it granulated subsequently in satisfactory fashion. The draining, epithelialized sinus tract in the proximal end of the tibia was excised and a mass of infected, purulent bone chiseled free and removed. This left a defect the size of a golf ball in the tibia. Only a thin membrane of granulation tissue and degenerated cartilage separated this cavity from the knee joint. Sulfanilamide crystals were instilled, gauze impregnated with vaseline inserted, and the corners of the soft tissue wound closed with black silk. The extremity was placed in a posterior mould of plaster of paris.



FIGURE 1.—External appearance of sinus before operation.

The patient stood this procedure well. There was copious drainage from the wound and he ran a slight elevation in temperature for 10 days. The penicillin was discontinued on the twelfth day and started again 3 days before the second stage.

On 5 December, under pentothal anesthesia the second stage was carried out. The wound was again carefully cleaned, all granulations curetted away and a few small sequestra still remain-



FIGURE 2.—X-ray of tibia before operation.

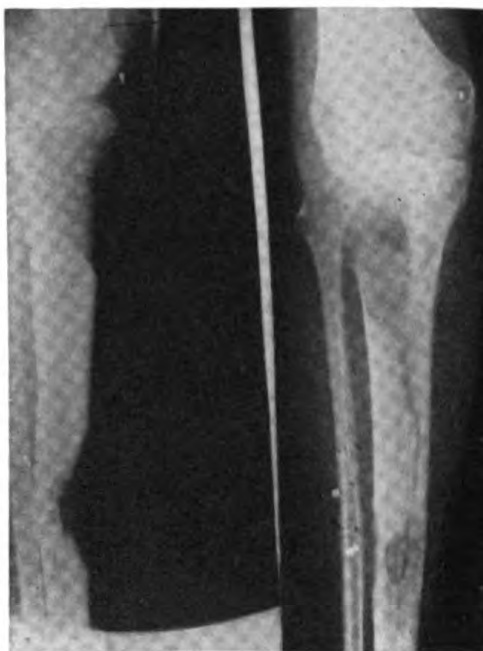


FIGURE 3.—Following first stage operation.



FIGURE 4.—Six months after second stage. Bone grafts well united.



FIGURE 5.—Appearance of leg 5 months after second stage.

ing removed. It was filled with cancellous bone chips from the left ilium, taken from a point just inferior to and behind the anterior superior spine. The skin was mobilized around the edges but could not be closed until it was freed medially by a 4-inch incision in the long axis of the leg. The skin was then closed without tension. A cigarette drain was put into the lower end of the bone-chip filled defect through the new incision on the medial side of the leg. It was then possible to close the relaxing incision, although this was done under some tension. The leg was then put in a moulded posterior splint from toes to groin.

On 12 December the drain was removed but this was apparently too soon. The tract promptly healed over and in another week there was evidence of considerable fluid in the cavity. With a syringe and a large bore needle 50 cc. of bloody fluid was aspirated. The needle puncture then became a draining sinus which refused to heal. After 1 week, a No. 12 soft rubber catheter was inserted through this sinus and 100,000 units of penicillin instilled twice daily. Drainage gradually became less and by 14 February the catheter was out and the sinus closed. The operative incision had healed by first intention in 10 days and at no time showed signs of breaking down.

After this experience the insertion of the catheter for the local administration of penicillin immediately following the removal of the drain was made routine.

SUMMARY AND CONCLUSIONS

1. The problem of a successful termination of bone infections following severe trauma has been brought forcefully to the front by the experiences of the past two wars.

2. The multiplicity of corrective measures and operations indicate that the problem has by no means been solved.

3. A method is suggested for the treatment of these cases which has proved successful in six instances without failure. It consists of a two-stage operation employing an extensive debridement of infected bone and soft tissue in the first stage and instillation of cancellous bone chips and primary closure of the skin in the second stage. It differs from other methods in the emphasis placed on a short period of drainage through the intact structures on one side of the defect immediately following operation. This is followed by the local instillation of penicillin through a catheter inserted through the same tract. Penicillin is also used systemically throughout the procedure.

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THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



NEW DISCOVERIES IN THE PHYSIOLOGY OF THE KIDNEY

Neurovascular Studies of the Kidney and Their Implications

What is considered by a number of physiologists to be the most important advance in physiology since the discovery of insulin 25 years ago is the work published in 1946 by Trueta, Franklin, and others on the neurovascular mechanisms of the kidney.

The essence of this work is that by stimulation of vascular nerves the blood supply to the kidney cortex (the glomeruli) can be cut off without affecting the circulation to the medullary portion of the kidney. In other words, the circulation continues through the medulla while the cortex is ischaemic. Under such circumstances, the urinary output is diminished or entirely suppressed. The medullary vessels are capable of handling the additional blood during the by-passing of the cortex.

The significance of this is far reaching. In the first place it is the discovery of one of nature's protective devices for the kidney. Toxins in the blood can cause a stimulation of these vascular nerves and cause the blood containing them to bypass the cortex and prevent damage to it. Other noxious agents, certain mineral poisons for example, probably can do the same thing. This explains "sulfa kidney," and temporary suppression of urine in many conditions. Furthermore, this mechanism prevents a fluid loss in hemorrhage or shock and acts as a temporary dam across the kidney to conserve fluid in such conditions.

This functional "change over" or two-way switch of the circulation in the kidney has many other implications. It explains hysterical and emotional anurias or polyurias, and postoperative uremias. It is easily seen how the interpretation of all our renal function tests will have to be revised in the future.

Another implication is that this same mechanism in which chronic stimulation of these vascular nerves are concerned may be the basis of hypertension. Finally, it at once suggests studies of many other organs along the same lines, which may show circulation changes and effects of the same sort. The more one examines this new discovery, the more extensive are the ramifications and possibilities it offers.

A preliminary communciation on the work was printed in the *Lancet* 17 August 1946 and subsequently an account was given in the *Journal of Physiology* (British).



A CENSUS OF SPECIALISTS IN THE MEDICAL CORPS OF THE NAVY

In this age of specialization in medicine, it was thought to be a matter of general interest to make a census of the members of Medical Corps of the Navy who had been certified by the American Specialty Boards and those having Fellowships in the American colleges of the medical specialties.

A tabulation of the 1,620 members of the Regular Navy Medical Corps shows that 101 hold certification by the American Specialty Boards, and 162 hold Fellowship in the American Colleges. A numerical tabulation is listed below:

American Board of:

Anesthesia	1	
Dermatology and Syphilology.....	2	
Internal Medicine.....	25	
Neurosurgery	0	
Obstetrics and Gynecology.....	10	
Ophthalmology	7	
Orthopedic Surgery.....	1	
Otolaryngology	18	
Pathology	2	
Pediatrics	4	
Plastic Surgery.....	1	
Neuropsychiatry	6	
Radiology	15	
Surgery	7	
Urology	2	
	<hr/>	101
American College of Surgeons.....	102	
American College of Physicians.....	52	
American College of Chest Physicians	1	
American College of Radiology.....	7	
	<hr/>	162

Thus about one-sixteenth of the Medical Corps of the Regular Navy have been certified by specialty boards. Exactly one-tenth are Fellows of the Colleges. Many have both distinctions. Many of those having the certificate of the Board of Internal Medicine are also Fellows of the American College of Physicians.



THE SHORTEST AND MOST DANGEROUS JOURNEY IN THE WORLD

It has been said that if you were conscious of being born, birth would be more painful than death. To use a certain type of witticism, it is almost as dangerous to be born as to die.

From various statistics from the Bureau of the Census and other sources, approximately 40 infants die during the first day of life among 1,000 live births. In addition to this, nearly 30 more are born dead. A great many of these deaths are due to disease of the mother or the child before delivery and many more due to congenital defects, which are incompatible with life. Indeed, statistics which give the causes of death among the new born are not easy to obtain. As a consequence there is considerable difficulty in determining just how many deaths are due to injury, accidents, and delays during the process of birth itself. From various information, it would appear that at least one-fourth of the total loss from still births and deaths occur in the first day of life. As a conservative estimate, 15 deaths per 1,000 are probably due primarily to parturition itself and not to disease or congenital anatomical defects.

The distance traveled by the infant in the parturition canal is scarcely greater than 8 inches if measured from the inferior strait of the pelvis. This is equivalent to 15 deaths for each 666 $\frac{2}{3}$ feet traveled, or about 1 death for every 44 feet. This represents a death rate of 120 for each mile traveled. The tremendous mortality in such a journey is thus readily appreciated particularly if it is compared to the deaths per passenger-mile in automobile travel. Deaths from automobile accidents are so great as to attract wide attention, but if the deaths were 1 per every 44 feet traveled it would be appalling. Actually, the death rate per passenger mile from ordinary passenger automobiles in the United States in an average year was only 2.9 per 100,000,000 miles. This is about 1 death for 33,000,000 passenger-miles. This is trivial compared to 120 deaths per mile due to the process of birth. It is thus seen that the first journey that man takes into the world is by far the most dangerous he undertakes in life.

Furthermore, man can elect his mode of travel later in life and can choose that he considers safest. He has no choice, however, on this first and most perilous trip and it is perhaps a merciful provision of Providence that he is unaware of its dangers.



THE UNITED STATES PHARMACOPOEIA XIII

The new edition of the Pharmacopoeia of the United States, as its formal title reads, at once attracts attention by the placing of the English name of each drug as the heading with the Latin title below it. This is one of the most interesting features of the thirteenth revision. There are also a number of changes in official English titles. Diphtheria toxin for the Schick test is now to be called diagnostic diphtheria toxin; ethyl carbamate is changed to urethane; and purified talc to talc. Epinephrine hydrochloride spray is now epinephrine inhalation. Theophylline ethylenediamine has been changed to aminophylline.

There are many important additions. Among them are:

Alum Precipitated.	Gas Gangrene Antitoxin.
Anticoagulant Acid Citrate.	Helium.
Benzyl Benzoate.	Protamine Zinc Insulin.
Calamine.	Penicillin (includes dental cones, ointment, tablets, troches).
Carbachol.	Riboflavin.
Cholela Vaccine.	Sulfamerizine.
Coal Tar.	Surgical Sutures.
Corn Oil.	Thiopental Sodium.
Digitoxin.	Vinyl Ether.
Dextrose solution.	Yellow Fever Vaccine.
Diphtheria and Tetanus Toxoids.	

Dosages are given first in the metric system followed by the approximate apothecaries measure. In some instances, particularly in the case of vitamins or animal organic preparations, the average dose is described as "to be determined by the physician in accordance with the needs of the patient."

No effort has been spared to make the monographs on the official preparations models of clarity and the facts are presented in a standard form making reference to certain features simple and rapid.

There is a section on the history of the United States Pharmacopoeia which is most valuable and the usual sections—general tests, processes, and apparatus; on reagents; and an appendix of useful titles.

This is one of the indispensable medical books and is in the medical library of every naval command. Medical men and pharmacists particularly will examine this new XIII revision with interest.



THE NATIONAL FORMULARY VIII

The new National Formulary VIII contains 188 new admissions. Among them are Sippy Powders. A sun protective ointment, pentobarbital elixir, gentian violet jelly, Phenobarbital capsules, and alcohol rubbing compound, to mention a few of the most commonly used preparations.

As is the custom in the past, many drugs deleted from the U. S. Pharmacopoeia XII have been transferred to this Formulary. Antipyrine, Bismuth subnitrate, ergot, pills of ferrous carbonate, mercury bichloride, camphor spirit, phenyl salicylate, and oil of turpentine are some of the more historic medicinal substances to be demoted.

The National Formulary VIII became official 1 April 1947. Practicing pharmacists are expected to have this book in order to meet the requirements of many State pharmacy and food and drug laws.



THE UNIVERSAL DISEASE

In the February 1947 number of the Military Surgeon there is an editorial on the subject of "Years as a Disability," the thesis of which is that the aging process itself results in physical disability and should be recognized as such. A former Surgeon General of the Navy, Rear Admiral Rossiter, put this thought very well when he said that "There is a disease universal in incidence, hereditary, progressive, incurable, and invariably fatal. This disease is old age." It might be added that this is not a disease of man only. All animal and plant life are affected.

With the development of geriatrics as a special study of the diseases peculiar to the later decades of life, medical men might well give more consideration to this "progressive, incurable, and invariably fatal" condition. In the military service, it is important as it has a bearing upon retirement, fitness for duty under strenuous circumstances, physical examinations, and particularly on physical standards. It is more than questionable if we should not have definite tables and regulations

setting up different standards for different age groups. Visual acuity for a midshipman of 18 and a captain of 50 are quite different things. Even height and weight vary markedly with age, while standards for the vascular system are radically different, even for age 18 and age 30. It would seem that this subject of the progressive changes due to the aging process is one that demands more attention and research than has been given to it in the past, and that there is an important and promising field for study here.



PREPARATION AND PALATABILITY OF FOOD IN RELATION TO NUTRITION

Although a definite connection between appetite and digestion has long been an established scientific fact and a still longer matter of common knowledge, the importance of the acceptability of food has frequently been overlooked in the preparation of food by institutions and for large groups such as military establishments. Rations have been carefully computed as to the amounts required, weights, and calories. The balance of proteins, carbohydrates, or other food classes are carefully considered and qualified medical officers consulted in such matters. The question of palatability has had little or no attention. It is particularly the case where special preservation used for emergency foods particularly are neglected in this respect.

There is the story of a cruiser belonging to an Allied nation which received a quantity of such condensed or dehydrated food from one of our ships and sent a signal asking, "How do you cook it?" Some hours after receiving these directions another signal was received, "How do you eat it?" This story may or may not be true but it exemplifies the point that food to furnish nutrition must not only be nutritious but edible. The two are not by any means synonymous though often thoughtlessly regarded as such.

Polar expeditions and also military operations under arctic conditions, both of which are receiving much attention at present, will call for further study and development of suitable rations. Furthermore, the emergency foods suitable for the tropics are not necessarily suited to cold climates. In these studies, and indeed in all studies of nutrition and metabolism, more attention and effort should be given to the appearance, flavor, consistency, and other attributes of the food which make it appetizing and easy to eat.

CLINICAL NOTES



DENTIGEROUS CYST

A CASE REPORT

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and
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Commander (DC) U. S. N.

The patient, a white male, aged 28, was admitted to the U. S. Naval Hospital, Aiea Heights, with the complaint of a foul discharge in the mandibular left third molar region. While on duty in Okinawa, he complained to a dental officer of a swelling in the lower left molar region with drainage distal to the second molar. X-rays revealed considerable destruction of bone in the left ramus of the mandible, and he was evacuated to this hospital for further treatment.

CASE REPORT

Examination.—Oral clinical examination revealed normal mucous membrane in the third molar region, except for a fistula immediately distal to the second molar, from which a cheeselike exudate with an offensive odor could be evacuated upon applying pressure to the soft tissues lingually. Palpation disclosed the fact that the lingual plate was entirely destroyed. The third molar tooth was missing. The second molar tooth responded positively to vitality tests. No adenopathy was present.

Oral radiographic examination revealed a deeply impacted third molar tooth directly inferior to the apices of the roots of the second molar tooth. The crown of this tooth communicated with a radiolucent area, which extended posteriorly into the ramus of the mandible and upward nearly to the mandibular notch. The distal root of the second molar tooth exhibited slight resorption (figs. 1 and 2).

A diagnosis of infected dentigerous cyst was made and the patient prepared for surgery. Nembutal $1\frac{1}{2}$ grains were given the morning of the operation and again 1 hour before operation. Morphine sulfate $\frac{1}{4}$ grain with atropine sulfate $\frac{1}{150}$ grain were given on call.

Surgical procedure.—Under conduction and infiltration anesthesia, an incision was made well up on the external border of the ascending ramus extending down over the crest of the alveolar ridge to the distal of the second molar and then diagonally and anteriorly along the buccal plate to the mucobuccal fold in the region of the first bicuspid. The mucoperiosteum was elevated and retracted buccally exposing the buccal plate of the body and ramus of the mandible overlying the cyst. Using surgical burs, numerous holes were bored along the buccal plate through the bone to the cystic sac. The bone was removed with rongeur forceps. The buccal plate, over the cyst and second molar, was removed completely to a point just above the lower border of of

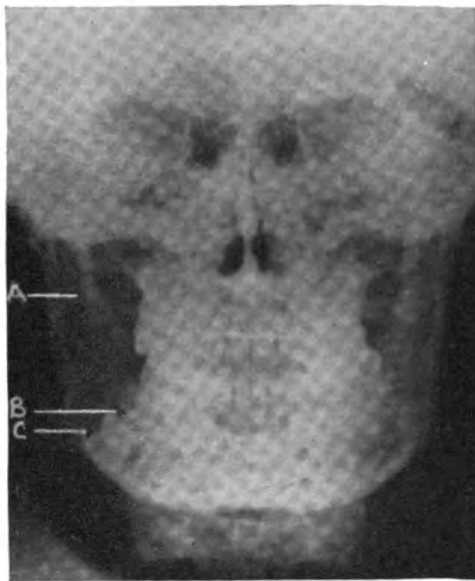


FIGURE 1.—Posterior-anterior view. A, Superior border of cyst; B, impacted third molar tooth; C, inferior border of cyst.

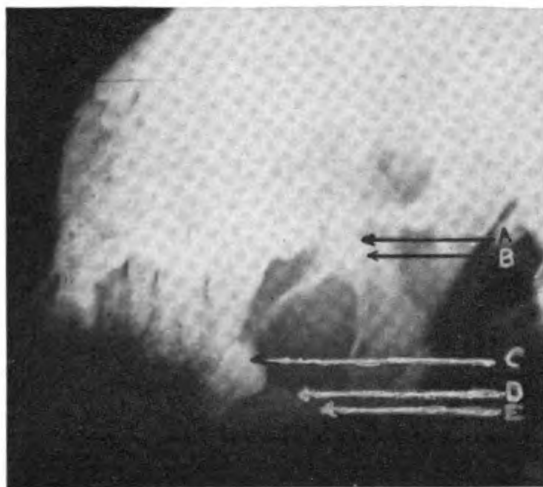
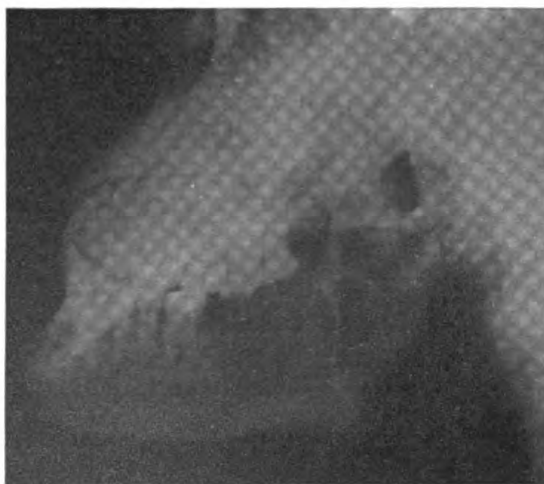


FIGURE 2.—Left lateral view. A, Mandibular notch; B, superior border of cyst; C, impacted third molar tooth; D, mandibular canal; E, inferior borders of cyst.

the mandible. The second molar was removed, care being taken not to exert too much pressure because of the thinness of bone in this area and the possibility of fracturing the mandible. The roots of the impacted third molar were firmly fixed in their alveoli. In order to conserve bone, the crown of the third molar was separated from its roots by using a crosscut fissure bur at the cemento-enamel junction. The roots were elevated from their alveoli with little difficulty. The cyst was enucleated en

FIGURE 3.—Postoperative view.



masse with periosteal elevators and curettes. A thorough debridement was made of the bony defect (fig. 3); 20,000 units of penicillin, incorporated with sulfanilamide in the form of dental cones, were inserted into the bony cavity, over which a mixture of human thrombin and a saline solution incorporated in fibrin foam was placed to control postoperative hemorrhage. An iodoform gauze dressing was loosely packed over this and completely filled the bony cavity. The mucoperiosteal flap was sutured with 000 dermal in its normal position, leaving adequate space for changing the dressing.

Postoperative course.—The patient was advised not to yawn widely or bite anything hard or tough, because of the possibility of fracturing his mandible. He was put to bed with an ice bag on his left jaw throughout the night. Codeine sulfate, $\frac{1}{2}$ grain, with aspirin, 10 grains, was all that was required for sedation. A liquid diet was prescribed. The first postoperative day, the patient experienced no great degree of pain and had a moderate amount of edema of the buccal soft tissues and trismus present. The patient noted paraesthesia of his lower left lip, which was expected following such an operation. The postoperative course was uneventful. On the fifth postoperative day the dressing was removed and replaced with another dressing. Subsequent changes of dressing were made at intervals for about 2 months, at which time the cavity had filled in with granulation tissue. Paraesthesia existed for a period of 1 month, after which time sensation gradually returned to normal.



NONPENETRATING WOUNDS OF THE SMALL INTESTINES

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Acute abdominal pain following a blow on the abdominal wall usually indicates rupture of a viscus. A direct blow, which is powerful enough to disrupt the intestine, will often cause a tear of the fascia and crushing of the abdominal muscles. Injury to the small intestine may be present even when there is only an abrasion on the skin. Two types of injury may occur: (1) a "blow out" of the wall as a result of increased intraluminal pressure, or (2) direct trauma to the bowel wall. The first will be found on the antimesenteric border. The second may be at the mesenteric attachment. In the latter the bowel is caught between the object and the vertebral column.

There will be a history of trauma followed by pain. The pain is steady and severe in character. It is caused by peritoneal irritation from the contents of the bowel and may follow the injury at once, although there is sometimes a delay of several minutes or an hour. The pain gradually increases in severity. It is likely that direct trauma to nerve endings produces anesthesia and consequently there is delayed pain. The delay may also be due to the slow leakage of the

semisolid contents of the small bowel. By the time the medical officer sees the patient, he is in extreme pain.

The patient may be in temporary shock but this passes off quickly. He is restless and lies on his side with his knees drawn up; the abdominal muscles are rigid and the patient is unable to relax them. There is general tenderness which is more pronounced in the region of the trauma.

After several hours the pain becomes less severe. Peristalsis, which was audible, disappears. In late cases the abdomen becomes soft and a diagnosis is more difficult to make. Signs of general peritonitis will be present after 24 hours. In early cases, temperature is usually normal but the pulse and respiratory rate will be elevated. Blood pressure will be normal. The leukocyte count will be increased. The red blood cell count will be normal.

In differential diagnosis one has to consider ruptured spleen, perforated peptic ulcer, ruptured bladder, mesenteric thrombosis, and coronary thrombosis.

On examination, it will be obvious that an acute surgical condition exists. Roentgenographic examination does not usually show free air under the diaphragm because the small intestine is normally free of air.

Although hemorrhage is not a serious problem, the patient should be cross-matched and blood prepared for immediate use if necessary. Intravenous fluids should be given to combat secondary shock.

OPERATIVE CONSIDERATIONS

Operation must be performed immediately.

If a competent anesthetist is available, spinal anesthesia affords best relaxation. A paramedian incision in the involved quadrant is best for exploration. Some free fluid may be present. A large amount of free blood indicates impairment of the spleen or liver.

In nonpenetrating wounds, rupture is usually single, but a thorough exploration must be made. The involved loop should be isolated and the peritoneum packed off carefully with moist gauze.

"Blow out" wounds are on the antimesenteric border and are usually about 6 inches from the ligament of Tretiz. The mucosa is everted and there are no changes in the surrounding serosa. The opening can be closed transversely with a continuous suture reinforced with interrupted silk.

When the bowel has received a direct blow and has been crushed, it is necessary to decide whether closure or resection is preferable. Such wounds may be found near the mesenteric border. In this type there will be danger of seepage and peritonitis. If there is hemorrhage into the bowel wall and mesentery and the serosa appears dull, resection of the injured loop should be done. If primary closure seems

advisable and the injury is low in the bowel, a catheter should be placed in the proximal loop about 1 foot above the involved area. Any free fluid should be aspirated and the abdomen closed without drainage.

Sulfanilamide should be placed in the peritoneal cavity as a precaution. In cases of several hours' duration 100,000 units of penicillin should be sprayed around the peritoneum with a syringe and fine needle, and the patient should be given 30,000 units of penicillin intramuscularly every 3 hours.

CASE REPORTS

Case 1.—A seaman, second class, aged 19, tripped on iron pipes and fell to the ground. He struck the upper left quadrant of the abdomen on a cement block which was about 2 feet high. He was knocked breathless but not unconscious. He had a sudden momentary sharp pain but was able to walk to his barracks. The pain continued generalized and dull and after half an hour began to localize under the ribs. The patient became nauseated but did not vomit. The pain remained continuous and gradually increased in severity.

The patient was seen by a medical officer and transferred by ambulance to the hospital. On the way the pain became so intense that the ambulance was stopped and the patient was given a hypodermic of morphine. The patient was admitted to the hospital 3½ hours after the accident.

Examination.—On admission the patient's temperature was 98.6° F.; pulse rate 84, and respirations 16. The blood pressure was normal.

Despite the morphine, the patient was in extreme pain. He preferred to be on his left side with his knees drawn up. He was unable to straighten his legs because of pain. Both the recti muscles were tense but there was more rigidity of the left upper rectus with tenderness in this area. There was no evidence of free fluid in the abdomen. Peristalsis was present. The patient was able to void and the urine was normal.

The red blood cell count was 4,310,000 with hemoglobin, 12.5 grams. The white blood cell count was 7,800 with 75 percent segmented cells, 1 percent band, 5 percent monocytes, 1 percent basophile, and 18 percent lymphocytes.

Diagnosis.—The patient was admitted with a tentative diagnosis of ruptured spleen. In view of the normal red blood cell count and absence of signs of shock, a ruptured intestine was considered possible.

Operative preparation.—The patient was cross-matched. Intravenous administration of 5 percent dextrose solution was begun. The patient was prepared for surgery at once.

Operation.—The operation was started 40 minutes after admission and about 4 hours after injury.

Aspiration was performed under spinal anesthesia.

On opening the abdomen through a left upper rectus incision, no free blood was encountered. The stomach was normal. Six inches from the ligament of Trietz on the antimesenteric border of the jejunum, a hole about 1 cm. across was found. The edges were ragged but there was no hemorrhage into the bowel wall.

The involved loop was blocked off with gauze and sutured transversely. A continuous atraumatic chromic suture was used, reinforced with interrupted silk. The remainder of the intestine was normal.

Sulfanilamide, 4 grams, was dusted into the peritoneum, and the wound was closed in layers without drainage.

Postoperative care and course.—A Levine tube was placed in the stomach and suction was started. Sips of water were given by mouth and fluids intravenously for 3 days. On the fourth postoperative day a full liquid diet was given and the suction apparatus was removed.

The wound healed by first intention.

The highest temperature was 100.5° F. the day after operation. There was no untoward reaction.

The patient was kept in the hospital during convalescence and returned to duty after 5 weeks.

Case 2.—A seaman, first class, aged 32, was cutting a half-inch panel board with a power saw when a piece of the board about 3 feet long was thrown back by the saw and struck him in the right lower quadrant of the abdomen. He had only slight pain at first but did not continue at work. He was seen 1 hour later by a medical officer. The pain gradually increased in severity and was localized in the area of injury. Peristalsis was present at first but disappeared after 4 hours.

Examination.—The patient was admitted 8 hours after injury. There was nausea but no vomiting. He did not void. On examination, he was found to be thin and showed signs of abdominal pain which was general, although more severe in the right lower quadrant. There was an abrasion, 1 inch by $\frac{1}{2}$ inch, to the right of and below the umbilicus. The right lower rectus muscle was spastic with tenderness to palpation in this area. There was no evidence of free fluid or extravasation. Catheterization yielded 350 cc. of normal urine.

The white blood cell count was 16,100 with 63 percent segmented cells, 5 percent band forms, 2 percent monocytes, and 30 percent lymphocytes.

The temperature was 98.6° F.; pulse, 92; respirations, 28; and the blood pressure, 140 systolic and 70 diastolic.

Operative preparation.—The patient was cross-matched for transfusion. Intravenous administration of 5 percent dextrose in saline solution was begun and the patient was prepared for operation immediately.

Operation.—Under spinal anesthesia the abdomen was opened through a right paramedian incision. There was rupture of the fascia and right rectus muscle with hematoma. The peritoneum was intact. There was no free fluid present but the low ileum showed some congestion. There was a perforation, about 1 cm. in diameter, on the mesenteric border, about 3 feet above the ileocecal valve. Some spilling of bowel contents had occurred but was well localized, and was removed. There was some increased redness of about 4 inches of the involved loop of the ileum. The circulation appeared adequate. The rest of the bowel was normal.

The loop was isolated and the perforation sutured with a continuous atraumatic suture reinforced with interrupted silk. Sulfanilamide powder, 5 grams, was sprinkled in the peritoneal cavity. The wound was closed in layers without drainage.

Postoperative care and course.—The patient was given intravenous fluids with water by mouth. He was given penicillin, 30,000 units, intramuscularly every 3 hours.

There was some distention with ileus following operation. A Miller Abbott tube could not be passed through the pylorus.

Ileostomy.—Four days after operation, obstruction occurred and an ileostomy was done by the Witzel method.

Course.—The temperature returned to normal following the ileostomy. Liquid stools were observed 3 days after the ileostomy. The distention subsided but the patient appeared toxic.

Urinalysis revealed a trace of albumin, and the blood urea nitrogen was 13.6 milligrams. This elevation is often observed in crushing injuries.

The patient gradually improved. Urine and blood urea nitrogen returned to normal.

Six weeks after operation, the patient had an attack of abdominal pain which continued for 2 days and was relieved by a Miller Abbott tube.

Ten weeks after operation the patient was evacuated to the mainland for further convalescence.

SUMMARY AND CONCLUSION

Rupture of the small intestine may result from a blow on the abdomen. Such a rupture is usually single. A "blow out" may occur or the bowel may be caught and crushed between the object and the vertebral column.

The patient will have signs of an acute peritonitis which will spread quickly.

Early diagnosis and operative repair will give good results.

Two illustrative cases are presented.



CHORIONEPITHELIOMA ¹

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and

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Chorionepithelioma is one of the most malignant of all gynecological malignancies. It arises from the chorionic villi, and is characterized by an insidious onset, early, and usually massive metastases, and often a rapid exodus. The condition usually follows a hydatidiform mole, a normal labor, an ectopic pregnancy, abortion, or retention of placental tissue. Generally, the majority follow the hydatid mole, while a smaller percentage find their onset from other causes. The average age of the patient involved is 33 years. The tumor may occur along with the mole, or may manifest itself many months following the evacuation of a mole. Following abortions, the chorionepithelioma usually occurs later, exceptionally as long as 12 to 14 months after pregnancy.

The tumor is derived from the covering cells of the chorionic villi. The cells that take part in the growth are the cuboidal cells of Lang-

¹ Reproduction of x-rays by Ralph Ware, Chief Pharmacist, U.S.N.

hans, and the syncytial cells, both of which are derived from the trophoblast. Grossly the typical chorionepithelioma is a raised, somewhat circumscribed nodular tumor on the fundus of the uterus, composed of dark red, soft fibrous tissue. The growth is an invasive one, invading usually the myometrium, and the local blood vessels. Hemorrhage and necrosis of large or small foci in the uterus are not uncommon, and lutein cysts of the ovaries, similar to those of the hydatidiform mole are found in a minority of the cases. Being an invasive tumor, early distant metastases are common. The most frequent site of metastasis is the lung. Less frequently metastases to the brain, liver, spleen, and kidney are found. Local spread to the vagina is not uncommon.

The diagnosis of the condition is not difficult to make if the patient is closely watched following delivery, abortion, or evacuation of a hydatid mole. Serial Aschheim-Zondek tests following evacuation of a mole are helpful, in that an unexplained rise in titer of Prolan A makes the attending physician suspicious that malignant changes are taking place. The chorionepithelioma is usually manifested clinically by vaginal bleeding, and signs of metastases such as hemoptysis, chest pain, coughing, or dyspnea.

The treatment of the condition is not well outlined in our present literature, however, the consensus of opinion is that deep x-ray therapy to the pelvis and metastatic areas should be followed by a pan-hysterectomy and adnexectomy.

Early adequate treatment of the disease has caused a sharp decline in the statistical mortality, but the fact remains that with the rapid blood-borne metastases to distant organs, the chorionepithelioma is an exceedingly fatal growth, even when removed early.

CASE REPORT

Mrs. A., age 37.—The patient was admitted to the dependent division of the United States Naval Hospital, Portsmouth, N. H., on 22 January 1945 with a chief complaint of metrorrhagia. The patient stated that her last menstrual period was on 30 November 1944, 2 months before her admission. Following 2 days of normal flowing, the bleeding stopped, only to begin again 2 days later. She stated that the bleeding had its onset during the night, lasting for a few hours, and not associated with any pain. On 27 December, 1 month before her admission to this activity, the patient was admitted to a civilian hospital where she had a dilatation and curettage, with a supposed diagnosis of incomplete abortion. The pathological findings obtained at this procedure are not available to the writers. Following discharge, she remained asymptomatic until the early part of January when she had another episode of bleeding. Up to the time of admission to our service, she had five such periods of vaginal bleeding.

The patient's family history was noncontributory, and her past history revealed that she had a normal full term pregnancy 8 years ago.

Physical examination revealed a well-developed, well-nourished white female, not appearing acutely ill; however, having a pronounced skin pallor. Examination of the head, neck, and eyes, ears, nose, and throat revealed no remarkable

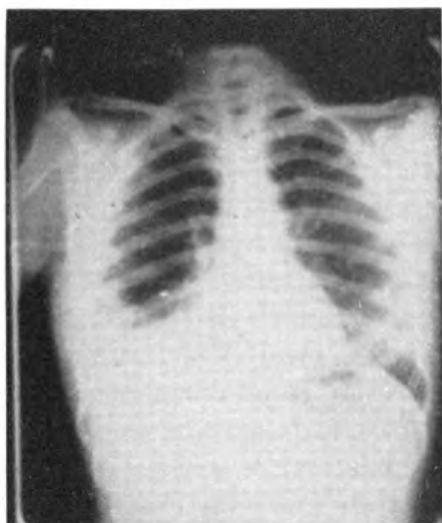


FIGURE 1.

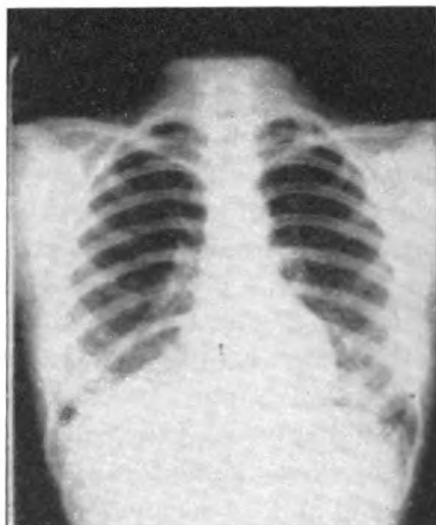


FIGURE 2.

findings. Chest: Symmetrical. Her lungs were clear to auscultation and percussion. Heart: Rate and rhythm regular. Abdomen: Supple, with no palpable masses or organs. Pelvic examination revealed the uterus to be in normal position and uniformly enlarged to the approximate size of a 3 months' pregnancy. The cervix was soft and the adnexa free. Examination of the extremities and the external genitalia was essentially negative.

Laboratory findings on admission were as follows: Urine: Negative. Blood: Rh Negative; red blood cells, 2.9 million; hemoglobin, 8 grams; white blood cells, 13,300; 72 percent segmented forms; 23 percent lymphocytes; 4 percent monocytes; 1 percent eosinophils. Kahn: Negative.

The patient was placed on supportive therapy, upon which she remained asymptomatic until 29 January, when she complained of severe right upper quadrant pain, which radiated into the back. Physical examination of the chest at this time revealed bronchophony, scattered râles and dullness in the right

base. X-ray of the chest revealed an increase in density of the right lower lobe, and obliteration of the costophrenic angle and right leaf of the diaphragm (fig. 1). The patient was started on chemotherapy with penicillin with the assumption that she was developing a pneumonia. Almost simultaneously with the pain, the patient began hacking blood. She claimed that it felt as if the



FIGURE 3.

blood were coming from the back of her throat rather than further down the respiratory tract. The patient was re-x-rayed at this time, and the findings showed complete resolution of the process at the right base; however, at this time two small densities were noted in the right upper lung field which resembled blood-borne metastases (fig. 2). The previous plate was reviewed and failed to reveal any such densities.

On 12 February, under gas, oxygen, ether anesthesia, a dilatation and curettage was performed, and a characteristic hydatidiform mole was evacuated from the uterus. At the time of this procedure a constant irregularity in the fundus was noted. Recovery from this procedure was uneventful; however, on 14 February, roentgenoscopic examination of the chest revealed the presence of many more small rounded densities (fig. 4). The hemoptysis continued. No muscle tissue was removed in the curettage, therefore no definite statement could be made whether or not malignant changes had taken place in the mole. In the presence of the above x-ray findings, and repeated negative smears for acidfast bacilli, a clinical diagnosis of chorionepithelioma was made.

The patient was prepared for surgery, and was taken to the operating room where a panhysterectomy and bilateral salpingo-oophorectomy were performed. Grossly, the uterus was moderately enlarged and very soft. The right tube and ovary were very dark and necrotic. The veins in the right broad ligament were dilated, and all tissues were friable, holding sutures and ligatures poorly.

Her postoperative recovery was uncomplicated; however, repeated x-rays of the chest revealed the previously described densities in both lung fields.

Microscopic examination of the specimen removed at the operation proved the diagnosis to be chorionepithelioma.

The patient was discharged to home on 28 March, at which time her weight was 132 pounds, and the Aschheim-Zondek test remained positive. She was advised at this time to have deep ray therapy to the chest. The deep ray therapy was begun on 2 April 1946. She was given spray therapy with 220 kilovolts, using $\frac{1}{2}$ mm. copper, and $\frac{1}{4}$ mm. of aluminum as a filter. The patient had a series of 16 treatments, with a total dosage of 3,120 roentgen units. She was seen in the out-patient department in between her x-ray treatments, and showed a definite gain in weight along with an appreciable rise in her blood count, and a marked diminution in the previously described hemoptysis. On the completion of the x-ray therapy, roentgenoscopic examination of the chest showed complete resolution of the parenchymal infiltrations. No pelvic bony pathology was revealed in the x-ray examination.

The patient was not seen again until December of 1946 because her husband was transferred to another section of the country. However, upon returning here, 10 months following her operations, a complete examination was performed. The patient weighed 153 pounds and claimed that she had never felt better in her life. She had remained asymptomatic since the completion of her radiotherapy. Physical examination revealed the patient to be in excellent

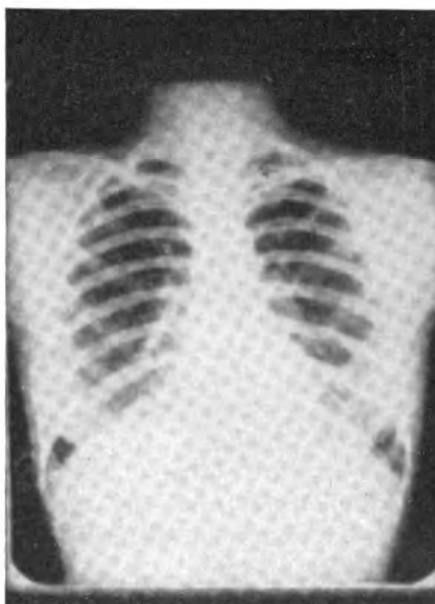


FIGURE 4.

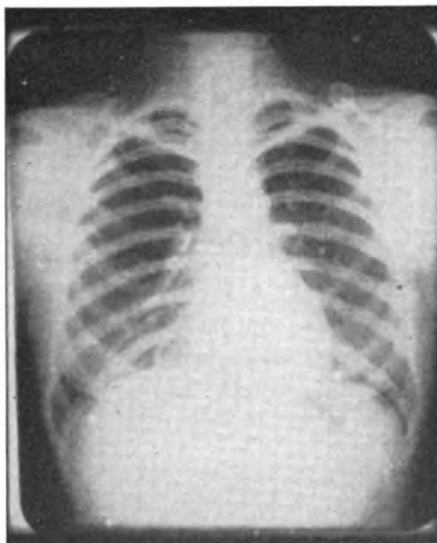


FIGURE 5.

spirits, with good color, and excellent nutrition. Physical examination of the chest was essentially negative; however, there was noted a slight respiratory lag of the right thoracic cage. Examination of the abdomen revealed no remarkable findings. Pelvic examination revealed no evidence of metastases into the vagina, however, there was noted a pea-sized growth protruding from the vaginal incision of her recent operation. This was removed and the site was cauterized. Pathological examination of the growth revealed it to be granulation tissue. X-ray examination of the chest, spine, pelvis, and long bones failed to reveal any evidence of a spreading malignancy (fig. 5).

SUMMARY

Radical surgery, followed by deep x-ray therapy to a metastatic site, apparently cured a patient with chorionepithelioma with massive metastases to the chest.

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HEMORRHAGIC SMALLPOX: REPORT OF A CASE WITH RECOVERY

TREATMENT WITH MASSIVE DOSES OF PENICILLIN

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This case is being reported with a threefold purpose in mind. First, smallpox, especially the hemorrhagic form, is no longer a commonly observed disease, thanks to the widespread policy of smallpox immunization brought about as the result of Edward Jenner's discovery of the cowpox vaccine in 1798. However, there are still endemic areas of the disease in certain parts of the world where our ships continue to call and where our military forces continue to be engaged in post-war occupational duties. With these facts in mind, the importance of prophylactic immunization, the early recognition and isolation of the sporadic case and the epidemiological aspects of the disease becomes obvious at once.

Second, approximately 26,500,000 units of penicillin were administered intramuscularly to this patient over a period of 20 days. It is readily acknowledged that penicillin has been used in the treatment of smallpox before the report of this case and we make no claims that it was effective against the virus component of the disease but we do feel that it was most important in making recovery possible for this patient. We also believe that penicillin therapy of smallpox and the dosage used in this particular case are worthy of further speculation and comment.

Third, because of this case and the possibility that similar cases might be imported to this activity in the future from forward areas, a program of prophylactic smallpox immunization was undertaken and all personnel attached to Navy Base No. 3245 were vaccinated, involving some 4,000 enlisted men and officers. Certain salient features learned from such an experience are thought worthy of emphasis at this time.

CASE HISTORY

C. H., a 20-year-old white male, SM2c, was a member of the crew of an LCS that departed Shanghai, China, 21 January 1946, en route to Saipan, Marianas Islands. The ship had been on the China coast for almost 2 months prior to that date and the patient had had liberty on the average of twice a week in Shanghai. At the time of his ship's departure he was and had been feeling quite well and during his visits to Shanghai had not heard or seen any evidence of smallpox.

The second day at sea he began to experience dull, aching, bilateral costo-vertebral angle and flank pain, more so on the right than on the left, and had to walk bent-over to get relief. There was no radiation of this pain and it was constant, not intermittent. Associated with this, there was frequency of urination which increased to two or three times per hour. The urine was described as being dark and cloudy but there was no dysuria. The following, or third day out, the back pain and frequency continued and he began to have chills and fever. He was put to bed and the convoy medical officer was informed. Due to rough seas the doctor was unable at the time to board the patient's ship but made a tentative diagnosis of urinary tract infection and prescribed sulfathiazole, 3 grams immediately, and 1 gram every 4 hours. The patient's temperature at the beginning of treatment was 104° F.

On 25 January (fourth day of illness) an erythematous, macular rash was noted for the first time, on the inner aspect of both thighs. Thinking the dermatitis might be due to sulfathiazole the drug was discontinued after a total of 5 grams had been given. The following day the skin eruption had spread to involve the trunk, arms, and lower legs. At this time the convoy doctor was able to transfer to the patient's ship and described the patient as being acutely ill, toxic, and delirious. The skin lesions had become papular with erythematous bases and were most marked over the legs, thighs, and forearms, but were also observed on the abdomen, chest, palms, soles, and face. Large, ecchymotic, purpuric extravasations were noted over the buttocks following penicillin injections which had been started when the sulfathiazole was discontinued. High fever and delirium continued and the patient began to have hemoptysis with production of grossly bloody sputum. The back pain and urinary frequency disappeared and the urine cleared considerably. The patient remained acutely ill and delirious and the skin lesions progressed. Some of the papules became vesicular and over the backs of the hands some of them coalesced to form bullous lesions filled with dark, hemorrhagic fluid.

Due to the gravity of the situation the patient's ship proceeded alone and arrived at Saipan during the early morning hours of 28 January, which was the patient's seventh day of illness. He was immediately transferred to the Navy Hospital at Saipan in a most critical condition.

The tentative admission diagnosis was acute sulfathiazole intoxication and acute nephritis.

The past history (obtained during convalescence) revealed that the patient had enjoyed excellent health all his life and that he had never had any significant acute or chronic illness. Childhood diseases had been the usual ones without sequelae.

Review of systems was entirely normal except for enuresis up to the age of 12. There was no history to suggest previous nephritis, or urinary tract infection. He had never had any operations nor sustained any significant injuries.

History of previous immunizations showed that he was vaccinated against smallpox at the ages of 6 and 12 and a third time November 1943 after entering the Navy. According to his statement none of the three vaccinations produced a noticeable reaction but his health record recorded an "accelerated reaction" in November 1943. Upon further questioning the patient was unable to recall any type of reaction.

Physical examination as recorded shortly after admission to the hospital was as follows: temperature 103.8° F.; pulse 110; respiration 24; blood pressure 120/60.

"The patient is an obviously desperately ill and febrile patient, age about 20, white male, with a very striking and marked generalized skin eruption. The skin lesions are most pronounced over the extensor surfaces of arms, hands,

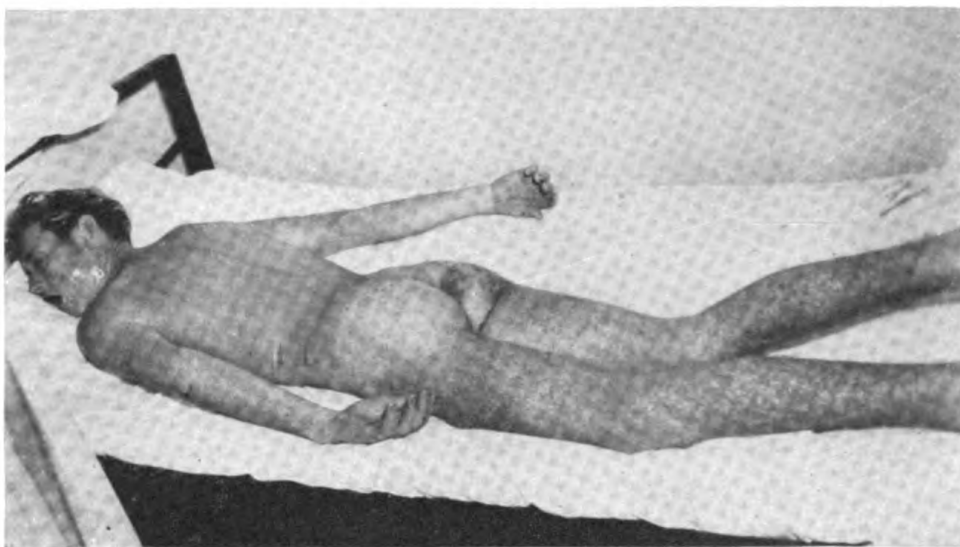


FIGURE 1.

legs, feet, chest, and abdomen. The forehead, sides of face and neck are also heavily involved but the upper back has been spared. The buttocks show large ecchymotic extravasations about the sites of entry of previous injections.

"The most prominent lesion is a diffuse, dark red, maculo-papular rash which has become confluent over forearms, hands, and lower legs. Superimposed on these lesions and scattered generally are large numbers of vesicular lesions in various stages of development. Many are small and grayish with little erythema. Others are larger, darker reddish-brown with umbilicated, necrotic centers.

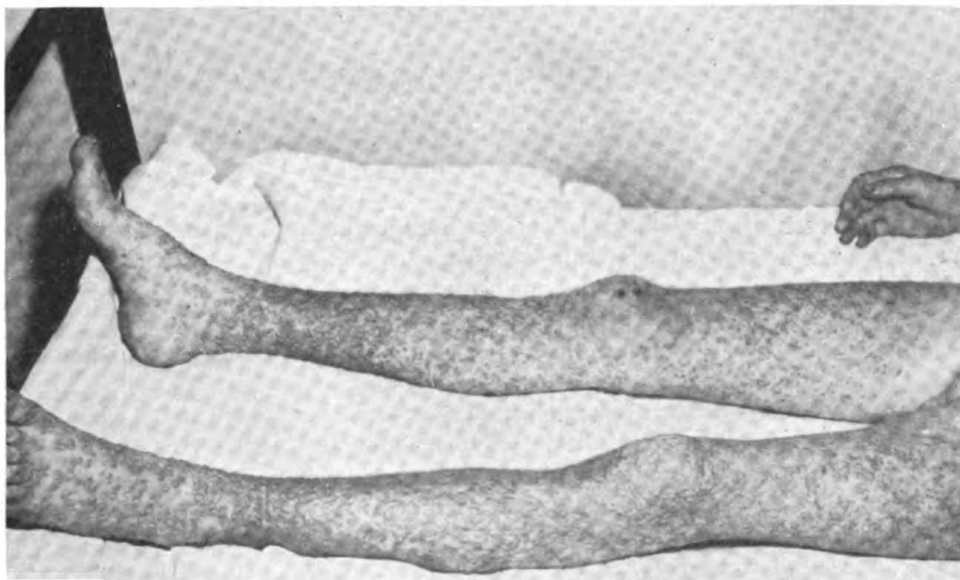


FIGURE 2.

Still others are much larger and even bullous, containing hemorrhagic fluid. Papular lesions are also seen in the palms and soles.

"Careful search fails to reveal the presence of a 'primary-take' smallpox immunization scar.

"*Lymphatics*: The axillary and inguinal lymphnodes are moderately enlarged but there is no generalized lymphadenopathy.

"*Head*: Not remarkable. No lesions noted in scalp.

"*Eyes*: Hemorrhagic suffusions are noted in both conjunctivae and sclerae, left more marked than right. Pupils round, react, and equal. No apparent weakness of extra-ocular movements. No nystagmus. Ophthalmoscopic not attempted at this time.

"*Nose*: Alae nasi rimmed with blood crusts and both breathing passages partially occluded by blood clots.

"*Mouth*: Lips swollen, darkly discolored and crusted by hemorrhagic areas and old blood. The tongue and gingivae are peppered by numerous small vesicular papules but at this time there is no bleeding from the gums. There are necrotic, hemorrhagic lesions in the roof of the mouth and in the oral pharynx with clotted blood and active bleeding. Tonsils moderately enlarged and involved in the process just described.

"*Neck*: No signs of meningeal irritation. No palpable abnormalities noted. Trachea in the midline.

"*Chest*: Symmetrical with equal expansion bilaterally. Lung fields resonant to percussion but coarse, moist rales are readily heard at both bases and over the precordium. No friction rubs heard. Breath sounds suppressed at both bases posteriorly.

"*Heart*: Precordium quiet. Rate 110 per minute. No palpable shocks or thrills. Not enlarged to percussion. PMI felt in left fifth interspace within the mid-clavicular line. Rhythm normal. Heart sounds of good quality, no murmurs heard but pulmonic second sound definitely accentuated and louder than the aortic second sound.

"*Abdomen*: Nothing of note.

"*Back*: Exquisite tenderness elicited by fist percussion over the right CVA and kidney region.

"*Genitalia*: Normal except for purpuric lesions in skin of penis and scrotum. No lesions or scars suggestive of old or recent venereal infection. No urethral discharge.

"*Rectal*: Fresh blood is noted about the anal region and on the rectal examining finger but no other abnormalities noted.

"*Extremities*: No edema, clubbing, or cyanosis.

"*Neurological*: Normal insofar as the patient could cooperate."

During the course of the examination the patient frequently coughed up bloody sputum and on one occasion vomited blood.

Initial laboratory data: Hemoglobin 11.5 grams; red blood cells 3,850,000; white blood cells 10,650; differential: polymorphonuclear leukocytes 78 percent; stab forms 3 percent; large lymphocytes 5 percent; small lymphocytes 14 percent. No abnormal cells were encountered in doing the differential but most of the segmented forms showed toxic granulation and fragmentation of the nuclei. Platelets were very rarely observed during the process of doing the differential.

Urinalysis: Clear amber; specific gravity 1.020; albumin 1 plus; sugar, negative; microscopic examination of sediment: 15-20 red blood cells per HPF; 4-6 white blood cell per HPF. Benzidine test strongly positive. No sulfathiazole crystals seen in sediment.

Blood chemistry: NPN 80 mg. percent; BUN 25 mg. percent; van den Bergh and alkaline phosphatase within normal limits. Blood sugar normal. Kahn blood test negative.

X-ray of chest report (taken at time of admission): "The lower two-thirds of both lung fields are infiltrated by a diffuse, coarse mottling which is in keeping with a diffuse bronchopneumonia. There is no evidence of free fluid in the pleural cavities and the cardiac silhouette is not remarkable for a supine film."

Impression: Fulminating hemorrhagic smallpox with hemorrhagic pneumonia and hemoptysis, toxic nephritis and hematuria and bleeding from the gastrointestinal tract.

This patient when first seen presented not an easy problem in diagnosis, especially in view of the possibility of complicating sulfathiazole intoxication and dermatitis and if one had never before seen smallpox. In a person sensitive to sulfathiazole the nephritis, the presence of which was so strongly suggested by the patient's early symptoms, could have easily accentuated all manifestations of this type of intoxication by virtue of the renal impairment. However, he denied having ever before received sulfonamide medication of any type and it is very unlikely that anyone would show such quick and overwhelming sensitization after less than a day's therapy which consisted of 5 grams in all.

The vesicular character of the skin lesions and the negative Kahn immediately ruled out syphilis and at this stage of the disease there was nothing to suggest scarlet fever or chicken pox, which must be considered in the earlier phases of smallpox. The Rickettsial diseases were also easily excluded by the vesicular nature of the skin lesions.

The thrombocytopenia and purpura could well have been due to sulfathiazole sensitivity but this as well as the hemorrhagic pneumonia and hemoptysis, the nephritis, back pain and hematuria, and gastrointestinal bleeding are all known to occur in the hemorrhagic form, or fulminating type of smallpox.

The marked decrease in platelets could be explained by toxic influence or destruction of the megakaryocytes in the bone marrow or by their destruction in the circulating blood stream. However, it is more likely that the bleeding was a result of generalized capillary damage and increased permeability and that the platelets were withdrawn from the blood stream in an effort to seal off the bleeding points.

The NPN-BUN discrepancy (80 mg. percent-25 mg. percent) was not only indicative of marked renal impairment but also suggested a failure of deamination as a result of liver damage.

Treatment and course in hospital: The patient was immediately placed in isolation and quarantined. For the care of the patient, three corpsmen were selected who had had fairly recent immune cowpox reactions. They were immediately vaccinated again and fortunately again were found to give immune responses.

Supportive measures were promptly instituted. He was placed in an oxygen tent which seemed to improve his breathing, decreased his coughing and lessen his delirium and restlessness. He was typed and cross-matched and given 600 cc. of ideally matched fresh, citrated whole blood without reaction. As much nourishment and fluid as possible were given orally and adequate intake and output were maintained by giving appropriate amounts of 5 percent dextrose in normal saline or distilled water parenterally. Supplements of vitamins K, B, and C were added to the parenteral fluids.

Barbiturates and opiates were intentionally withheld but sedation was satisfactorily obtained by intramuscular injections of paraldehyde. A solution of penicillin in normal saline was used as a mouth wash every 2 hours and special care was administered to the lip and mouth lesions.

Since death in fulminating smallpox is frequently due to beta hemolytic streptococcal septicemia and secondary pneumonia it was decided to use massive doses of penicillin in an effort to save this patient's life. It was obvious that there was nothing to be lost and everything to be gained by such a plan. Accordingly, he was started on 100,000 units of the calcium salt, to be administered every 2 hours, intramuscularly. In an effort to keep the volume per injection as small as possible, it was found that 200,000 units of the calcium salt contained in a vial could easily be dissolved in 4 cc. of normal saline, and later even in 2 cc. The sites of injection were observed carefully but there was no evidence of undesirable local or systemic reaction.

The following or second hospital day, found the patient still in a very critical condition. The temperature dropped from 105.6° F. the night before to 104° F. at this time; pulse 110, respirations 30, blood pressure 120/60. He was perhaps slightly less delirious than the previous day. The most significant change noted was in the appearance of the skin lesions. All of the papules now appeared as discreet vesicles with less erythema about their bases and many of them showed umbilicated, black, necrotic centers whereas others contained dark, hemorrhagic fluid. The bullous lesions over the backs of the hands and fronts of the knees became larger and darker and the vesicular character of the face, sole, and palmar lesions became much more distinct. Moist rales and suppressed breath sounds could still be elicited from both lower lung fields but coughing and hemoptysis were less. He continued to vomit and pass blood per rectum.

Laboratory data at this time was as follows: hemoglobin 7.5 grams percent; red blood cells 2,300,000; white blood cells 12,750 with a differential essentially as before. Bleeding time (from the lobe of the ear) 20 minutes plus; clotting time (Lee and White) 7 minutes; platelet count 34,000.

Another 500 cc. of fresh whole blood (the donors were selected from those showing immune cowpox reactions) was given and the penicillin was increased to 200,000 units every 2 hours. As stated above, it was found this amount could be satisfactorily dissolved in 2 cc. of normal saline and this was the volume used for this dosage thereafter.

Throughout the next 2 days (third and fourth hospital days) there was little evidence of clinical improvement except that there was less bleeding from the rectum and mouth lesions and less hemoptysis. The temperature continued between 103° and 104° F. All of the skin lesions became more distinctly vesicular, many of which assumed the double-contoured, "checkerman" appearance. The erythema continued to fade, leaving a dark, reddish-brown color in the skin about the vesicles.

Excision of the tops of some of these vesicles revealed them to be multilocular and to be filled with fluid that varied from a slightly turbid serous fluid to that which was definitely serosanguinous.

Cultures of the vesicular fluid and Paul's test (scarification of rabbit's cornea with vesicular fluid) proved to be negative.

Penicillin, 200,000 units intramuscularly every 2 hours and daily whole blood transfusions as well as parenteral fluids with vitamins K, B, and C were continued.

On the fifth hospital day he took a definite turn for the better. His temperature dropped to 100.2° F., pulse 90 and respirations 24. At this time he was completely rational and cooperative. The vesicles showed no further signs of enlargement, hemorrhage, or necrosis and the ecchymotic areas were beginning to absorb. The lip, mouth, and pharyngeal lesions appeared considerably improved although he complained of severe sore throat. The eyelid margins at this time were quite granular and crusted and quite uncomfortable to the patient. The lung fields

had cleared except for moderate numbers of moist rales at both posterior lung bases. Coughing was less and there was only slight hemoptysis. There was also very little evidence of rectal bleeding at this time and it appeared as though the bleeding tendency was under control.

After four whole-blood transfusions in 5 days his hemoglobin was 12.0 grams percent; red blood cells 4,200,000 and white blood cells 8,000 with a normal differential. The platelet count was 52,000. Urinalysis at this time was normal.

The penicillin dosage at this time (tenth hospital day) was decreased to 100,000 units every 2 hours and transfusions were discontinued after a total of seven had been given.

The first signs of desquamation appeared over the backs of the hands and fronts of knees on the tenth hospital day (seventeenth day of illness) and most of the vesicles generally had absorbed to the extent of leaving tightly adherent, dark, reddish-brown crusts, except over the feet and lower legs where some vesicles with fluid persisted. No frank pustulation of any of the lesions was observed.

The temperature continued to fall and as it did the penicillin dosage was decreased still further to 50,000 units every 2 hours and next the interval was increased to 3 hours, the a. m. injection being omitted.

The next few days brought continued involution and absorption of all the vesicles and beginning generalized desquamation of the crusted lesions. The skin of the dorsum of the hands, the elbows and knees were clear, except for slight residual pigmentation, and showed no evidence of scarring at this time. The skin of the tips of the fingers and toes was shrivelled, quite hard and dark as though superficially gangrenous but there was no ulceration. These were watched closely and given special care with applications of penicillin ointment.

He continued to show general improvement and the penicillin dosage was further reduced to 25,000 units every 3 hours. On the eighteenth hospital day he became afebrile and 48 hours later the penicillin was discontinued, after he had received a total of 26,500,000 units of the calcium salt intramuscularly. There was no local or systemic undesirable reaction to this massive dosage nor to the frequency of administration.

On the forty-first hospital day or 47 days after the onset of his illness he was discharged from the hospital and evacuated to the States for further convalescence. At this time the skin was completely clear of all lesions and there was no evidence of permanent changes, such as pigmentation or scarring. There was no evidence of impaired renal function and x-ray of the chest showed the lung fields to be clear. He felt quite well and was rapidly regaining the great amount of weight lost during his illness.

COMMENT

This case serves as an object lesson as to the importance of reliable and adequate prophylactic immunization against smallpox. It is altogether probable that had this patient been properly followed up and repeatedly vaccinated until a definite response was obtained in 1943 he never would have contracted the disease. It is true that his health record records his last vaccination in 1943 as an accelerated (vaccinoid) type of reaction but the patient emphatically denies that there was any noticeable manifestation of a reaction of any sort. It is our belief that the lack of visible response was misinterpreted as an "accelerated" response, whereas actually it meant either faulty technic

or an impotent vaccine. The absence of a "primary-take" scar on this patient is further evidence that he had never been immunized, and is in keeping with his testimony that he had never reacted to any of the three previous attempts at immunization.

All personnel going into these areas should be successfully revaccinated beforehand, regardless of when last vaccinated. A potent, fresh vaccine should be used, the skin properly prepared and one of the accepted, standard technics, preferably the multiple punch method, employed. The three types of reactions, i. e., immune (Jenner), accelerated (vaccinoid), primary-take (vaccinia), their manifestations and significance of each, should be thoroughly understood by those vaccinating and interpreting the reactions. Each individual vaccinated should be seen again at the end of 48 hours. If an immune reaction is present, it should be recorded as such and he needn't be seen again. It is reasonable to assume that those with immune reactions are not susceptible to the ordinary chances of infection. If at this time (end of 48 hours) there is no reaction, the individual should be seen again on the fifth day because if a vaccinoid reaction is present it will be at its height and the patient need not be seen again. If the reaction is progressing at this time but is not at its height, it is better to see the patient again on the ninth to eleventh day so that the vaccinia may be observed at its height and proper treatment of complications instituted if indicated.

If a reaction is not found on the second or sixth day the vaccination should be repeated, making sure a potent virus and proper technic are used. If, however, one waits until the sixth day to make the first observation, a large percentage of the immune reactions will have come and gone and a number of needless revaccinations necessitated.

One can only speculate as to the outcome of this case had penicillin not been used. As stated at the beginning we make no claims that the massive dosage used had any therapeutic effect on the primary causative agent in this disease but we do believe it altered the natural sequence in the progress of the skin lesions and prevented serious secondary infection in such susceptible locations as the mouth and throat, the lungs, the blood stream, and the skin. The skin lesions did progress through the characteristic mucule, papule, and vesicle but at no time was there any frank pustulation or obvious secondary infection. The vesicles absorbed, crusted over, and desquamated without ever showing evidence of purulent exudate. This was further attested to by the negative cultures of the vesicular fluid and blood. Unfortunately, cultures were not taken before penicillin therapy was begun.

Another question that will very likely arise in anyone's mind reading this report is whether the dosage used was necessary or accomplished any more than would have the average dosage. In view of

our present knowledge of the absorption and excretion of injected penicillin, we hoped by giving such a large amount per injection to increase the peak concentration and "penetrability" of the penicillin and by decreasing the interval between injections we hoped to sustain a higher, constant concentration in the blood. By contrasting the final appearance of this patient with that which he presented at the time of admission to the hospital we can only say that we think it was definitely justified.

This case also attests to the already accumulating data that massive doses of penicillin can be given in small volume, at frequent intervals intramuscularly over long periods of time without adverse local or systemic reactions.

ACKNOWLEDGMENT.—The invaluable assistance of Maj. M. J. Lepore (MC), A. U. S., Chief of Medical Service 369th Station Hospital, Saipan, Marianas Islands, in helping direct therapy in this case is gratefully acknowledged. It was also through his willing cooperation that special studies could be carried out in this case.



SKIN GRAFT OF THE PENIS

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This case is presented because it offers, perhaps, a solution to the problem of loss of skin of the penis by the utilization of the loose scrotal skin as a full thickness in situ graft. It can be used in any case where there is denudation of the skin of the penis whether the cause is from a burn, trauma, or as in this case chemical necrosis.

CASE REPORT

R. G. W., Case No. 237 was admitted to the U. S. Naval Hospital at Long Beach with the diagnosis: "Trombosis, veins of the penis." Nineteen days before admission he had been circumcised at sea for phimosis. Local infiltration of 1 percent procaine solution was used with a few drops (exact percentage not given) of adrenalin. Immediately following the injection which was given subcutaneously and annularly just posterior to the corona and again in the mid shaft region, it was noted that the skin became doughy and ecchymotic. When the skin was incised all the veins appeared contracted and the tissues were stained a bluish color.

The next day the temperature rose to 100° F., the skin of the shaft became darker, and then appeared to be a beginning abscess near the pubis. Sulfathiazole

was administered orally and wet dressings locally. All of the skin and mucous membrane of the penis sloughed away from the corona to the pubis, leaving a raw granulating area. He arrived at the hospital in this condition. The remainder of the physical examination was negative.

There was a note in the health record that an investigation of the procaine solution was made and it was found to be old (actual age unknown) and that it contained a white sediment. It was not cultured.

As soon as the granulating surfaces appeared uniformly red and all the necrotic areas sloughed off, the skin of the scrotum was prepared for surgery. Under spinal anesthesia a small opening was made in the lower portion of the scrotum just large enough to admit one finger. By blunt dissection a canal was undermined up to the shaft of the penis which was drawn through this canal and sutured. One layer of sutures united the skin of the incised portion to the corona. Two mattress sutures under the shaft of the penis brought the portions of the scrotum lateral to the penis together posteriorly. The upper defect in the skin which remained when the shaft of the penis was drawn down into the scrotum was closed horizontally by interrupted sutures of silk.

Ten days later the scrotum was incised longitudinally on each side of the penis and the two sides sutured together on the under surface of the penis making a complete covering for it. The defect left in the scrotum was closed without tension and healed per primam.

During the later stages of his surgical treatment he developed some mild convulsions which were diagnosed epilepsy and confirmed by the electroencephalogram. He was surveyed from the service on this diagnosis.

The end result of the skin graft was excellent. The appearance was quite natural and the function was reported to be normal in every way.

CONCLUSIONS

An excellent source of skin for defects of the epithelium of the penis is to be found in the scrotum. This is ideally located for use as a full thickness graft.

MEDICAL AND SURGICAL DEVICES



A SIMPLE METHOD OF CONVERTING THE STANDARD STERN-McCARTHY PROSTATIC ELECTROTOME TO A PISTOL-GRIP-TRIGGER MODEL

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The invention of instruments for transurethral surgery introduced a new era in urology (1). Since their introduction many improvements and modifications have been developed (2).

Today, probably the most popular instrument is that of Stern-McCarthy. Nesbit (4) and Scott (5) each has his own improvement upon the original. Others have also contributed (3).

The pistol-grip-trigger type mechanism of Scott was exceedingly interesting. With the aid of the machinist at the U. S. Naval Hospital, Great Lakes, Ill., it was possible to improvise a pistol-grip-trigger model with the conventional Stern-McCarthy instrument.

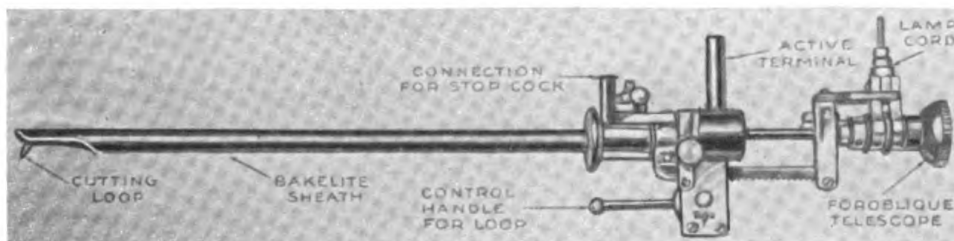


FIGURE 1.—Conventional Stern-McCarthy resectoscope.

The gear and arm arrangement on the standard model for movement of the electrode were removed. The geared bar was replaced by one of the same size minus the gear meshes and ground with a bevel on each surface. A spring was placed behind the sliding element attached to the electrode to push it forward on completion of a cutting stroke.

A pistol-grip handle made of light aluminum was attached to the posterior suspension bar and lens holder. The trigger is attached to the old gear box, making index finger control of the cutting element possible.

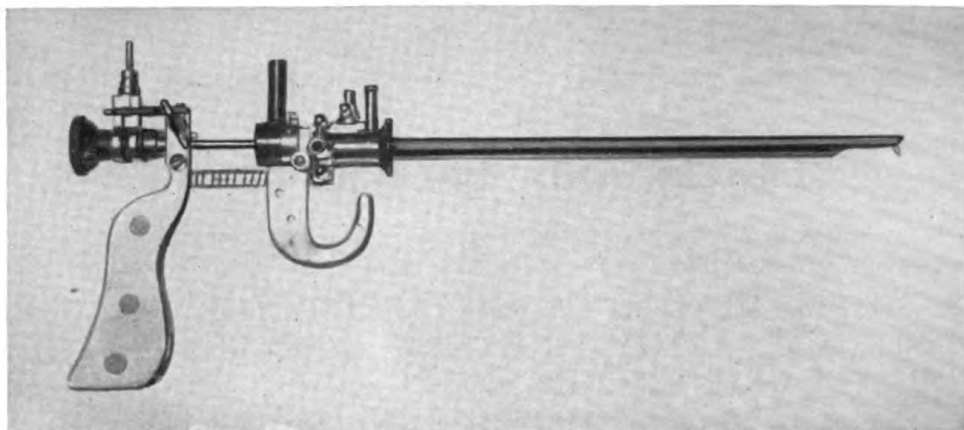


FIGURE 2.—The standard Stern-McCarthy instrument converted to a pistol-grip-trigger type instrument.

The cost of making this conversion is slight. The instrument works satisfactorily, greatly facilitating the speed of resection over that accomplished with the conventional model. In a matter of a few minutes the instrument may be converted from the standard to the pistol-grip model or vice versa. The handle is held in place by two screws and the trigger by two screws.

There is a great deal to be desired in this instrument as has been described by the authors referred to. Until the Scott instrument becomes available to naval hospitals, such a make-shift arrangement is offered as a workable mechanism.

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ADJUSTABLE APPLIANCE FOR INTRA-ORAL IMMOBILIZATION OF FRACTURES OF THE MANDIBULAR ANGLE¹

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The proper reduction and fixation of the ramus in fractures of the angle of the mandible can sometimes be one of the most perplexing problems in the entire field of treatment of fractures of this bone. In simple fractures of this type, the line of fracture may be so located that an elevation of the posterior fragment is prevented by the interference of the anterior fragment. In cases in which the direction of the fracture line is such that it permits the elevation of the ramus, there are several methods of treatment for the reduction and stabilization of this unruly fragment. In this group may be included the compound splint, the acrylic splint (fig. 1) (1); the open reduction approach; the posterior traction techniques (2); the various skeletal fixation procedures (3); and the intra-oral wire fork (4). It is only in those situations in which the ordinary methods of treatment are not successful that the ingenuity of the dental officer may be taxed (fig. 2).

None of the above procedures are very satisfactory in a condition where a large part of the body of the mandible has been lost and where the ramus has been elevated into the buccal tissue with subsequent shortening of the fibers of the masseter and temporal muscles. A condition of this sort would be even more difficult to treat if it were

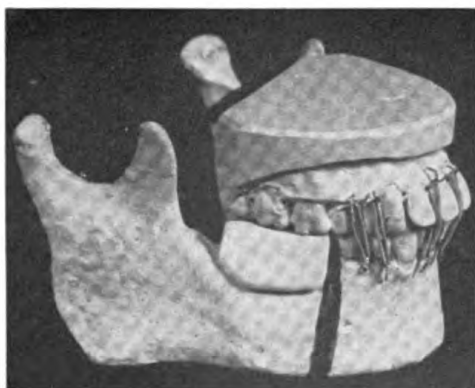


FIGURE 1.—Acrylic splint used to correct elevation of posterior fragment by restoring the original occlusal dimension. The fracture lines are indicated in right premolar and left subcondylar areas.

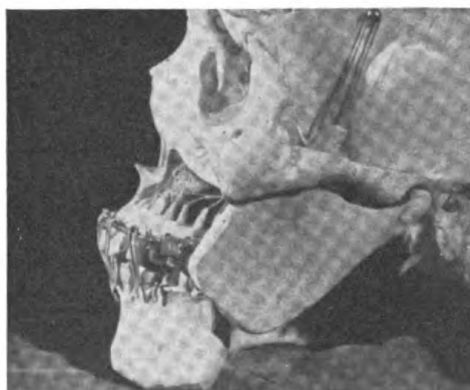


FIGURE 2.—Skull showing elevation of ramus of mandible due to pull of temporal and masseter muscles.

¹ Photographs used in this article were taken by Lt. Comdr. A. Alec Gravesen, H(S), U. S. N. R.

further complicated with scar tissue. In this type of problem it is necessary to depress the ramus to its normal position and maintain it thus, possibly for several months, for the insertion and healing of a bone graft.

In cases of this type, impression compound or plastic splints are contraindicated because there is no way of controlling them after they have been placed, and there is often no way of maintaining them in position. There is also danger of sloughing and ulceration of the underlying mucosa since there is no way of cleaning under the splint.

The surgical methods including external skeletal fixation appliances are usually not satisfactory because there is a possibility of their jeopardizing the bone graft due to the possibility of local infection around the openings in the bone. Naturally, the closer the pins or holes to the site of the graft, the greater the accompanying hazard. There is also the possibility of loosening of the pins before healing has taken place. In addition, the external pin appliances may interfere with the procedure of placing the graft, extraorally, and the appliance may be loosened while the graft is being placed in position.

In order to satisfactorily treat a patient affected as described it is necessary to have an appliance which will satisfy the following requirements:

1. Hold the ramus in position over a prolonged period with minimum discomfort to the patient.
2. Be adjustable so that the ramus can be reduced gradually if necessary.
3. Open no new potential avenues of infection which might place the bone graft in jeopardy.
4. Be removable and replaceable without affecting the fixation of the anterior fragment.

To meet these requirements, it was found most satisfactory to modify a jack screw appliance of a type which has been in use for many years. This appliance was attached to an upper cast dental splint and exerted pressure against a vellum rubber saddle on the anterior aspect of the ramus (5). There were certain objections to this type of appliance which it was necessary to eliminate before it would satisfactorily meet the above requirements. A great deal of laboratory time was required for the construction of the appliance, which could be used only once and was then discarded. There was no way of maintaining satisfactory hygiene with accompanying risk of infection. The patient had to wear the appliance until completion of treatment, when actually intermaxillary wiring would have been sufficient fixation after the graft had been in position for a few weeks.

These objections were overcome by constructing an appliance which could be soldered to a standard fracture arch bar and which could be

unsoldered and used over again after the completion of treatment. It could be readily loosened, or even removed from the mouth for cleaning. Pressure could easily be exerted in the desired force and the direction of the pressure could be changed at will and maintained in the desired position. It was decided to use an acrylic resin or flexible acrylic resin saddle, or preferably a combination of both, as opinion seems to concede that these materials are cleaner and better tolerated by the oral soft tissues than either vulcanite or vellum rubber.

The appliance consists of a silver plate, which is called the female part and which is slotted for one-half its length and is soldered to the arch bar; and a stainless steel plate, or "male part," with a small button on it which will slide freely into the slot of the female part. Beneath the button on the male part there is a threaded hole extending from the mesial to the distal surfaces. The button on the male part and the slot of the female part are both flanged so that the button can be introduced into the slot from one side only. To complete the appliance there are stainless steel bolts, 1 inch, $1\frac{1}{4}$ inches, and $1\frac{1}{2}$ inches long, which are threaded to accommodate the hole in the male part and which have been squared at both ends to fit a socket wrench. This provides an extra head for each bolt in the event that one head becomes damaged. There is also a silver wheel which may be contoured to cover the saddle area and which has a $\frac{1}{2}$ -inch long tube extending from its hub which will freely accommodate the end of one of the bolts. The remainder of the appliance consists of a socket wrench to fit the bolt heads, and a small silver nut, threaded to fit the bolts (fig. 3).

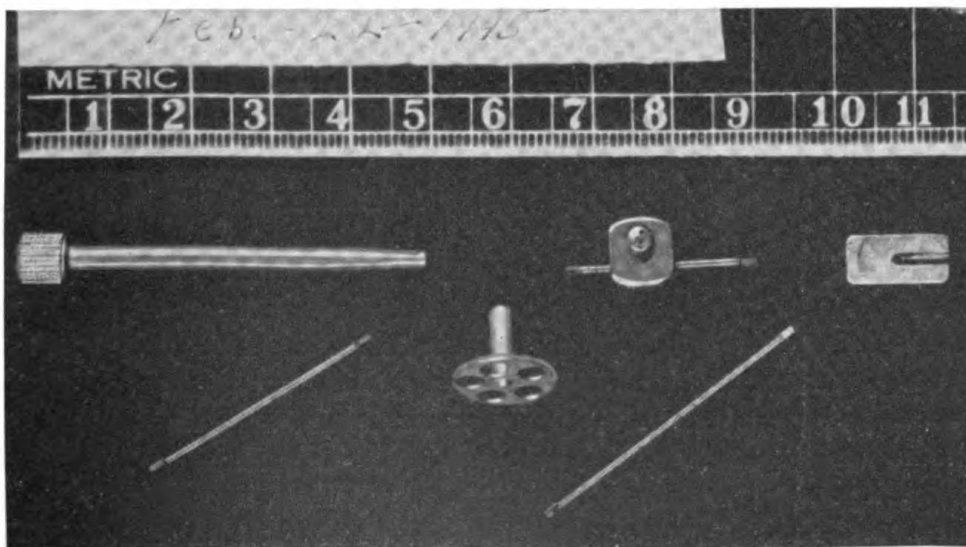


FIGURE 3.—Parts of adjustable intraoral appliance showing (left to right) socket wrench, $1\frac{1}{4}$ inch bolt, silver wheel with socket, stainless steel male part with 1 inch bolt, $1\frac{1}{2}$ inch bolt, and silver female part. The round silver nut is not shown.

To insert the appliance, an arch bar of the Winter, Stearn, or Jelenko type is contoured, but not wired, to the upper teeth. The male part of the appliance is attached to the female part, one of the bolts is passed through the male part with sufficient length extending to engage the entire length of the tube of the silver wheel. The female part is attached to the arch bar with sticky wax in such a position that by screwing the threaded bolt distally the flat surface of the silver wheel will engage the proper saddle area on the anterior surface of the ramus. The wheel can then be contoured to conform to the selected saddle area. The silver wheel is now surrounded with bite wax, baseplate wax, or impression compound, and an impression of the saddle area taken. This impression is contoured so that it will not impinge on buccal or lingual tissue and so it can be easily inserted or removed from the



FIGURE 4.—Appliance in position to immobilize simple fracture of mandibular angle. Intermaxillary fixation has not yet been applied.



FIGURE 5.—Appliance in position immobilizing ramus prior to the placement of bone graft.

buccal side. The appliance and impression are reinserted in position, and if any changes are necessary they are made at this time. The female part is now soldered to the arch bar with silver solder, and the impression, or model, with the silver wheel imbedded, is processed in acrylic resin. It is believed best to have a lining of flexible acrylic resin, on that surface of the saddle which lies against the ramus. The arch bars are now wired in position thereby immobilizing the anterior fragment. The appliance is then placed in position and the bolt adjusted to reduce the ramus to the most satisfactory position. If the desired result cannot be obtained immediately, additional pressure should be applied daily (figs. 4 and 5). The silver nut is then placed in position on the free end of the threaded rod where it serves to protect the buccal tissues. Rubber bands placed on the bolt, in contact with the silver nut and extending to one upper and one lower lug on the respective fracture arch bars, will control the proper vertical position of the bolt and therefore the saddle (fig. 6). The appliance is allowed

to remain in position for a few days to insure that it will cause the patient no discomfort. If no changes are indicated, any further treatment, such as the placing of a bone graft, may be performed. It is believed best to clean the mouth daily while the arch bars are in place, and to loosen the appliance from time to time and irrigate under it.



FIGURE 6.—Appliance in position showing control of vertical position of splint by use of rubber bands in silver nut.

The appliance, once constructed, has several uses. It can be modified for use as a jack screw to prevent contraction of the mandibular arch in fractures of the midline accompanied by loss of bone. It can also be used to maintain the remaining parts of the mandible in position when resection for adamantinoma or other neoplasm is contemplated. In cases of this sort the saddle, fixation of the female part, and placing of the fracture arch bars should be completed before surgery is performed. The appliance can also be used in the treatment of fractures of the angle of the mandible where there has been no loss of bone. In these cases, if there has been no elevation of the posterior fragment, it is necessary only to solder the female part in position at the time the fracture is reduced, and the saddle can be processed and the remainder of the appliance placed only if displacement actually occurs. In cases of this sort the appliance can be removed without disturbing the fixation of the other fragments as soon as it is felt that sufficient healing has taken place to retain the posterior fragment in position. In edentulous cases, where it is indicated, two inch-long 14-gauge wires should be soldered across the back of the female part and then imbedded in an acrylic-resin splint.

SUMMARY

The accepted methods of treatment of fractures of the jaws are not always suitable for the fixation of the parts of a mandible in which a considerable amount of bone involving the angle has been lost. An appliance is described which attempts to eliminate the difficulties ordinarily encountered in the treatment of a condition of this sort. This appliance is not intended to replace the accepted forms of treatment in conditions where their use is indicated. It is offered as a suggestion to be considered in the few conditions where it may be of value.

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BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

AN INTEGRATED PRACTICE OF MEDICINE, by *Harold Thomas Hyman, M. D.* Volumes I, II, III, IV, and Index. 4,131 pages; 1,184 illustrations, 305 in color; 319 differential diagnostic tables. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$50 per set.

This is a tremendous work, a practice of medicine in four large volumes in addition to a small index volume. Furthermore, it is the production practically of one author, although a few collaborators were employed. The whole is done with a great amount of completeness. Each case is covered from early symptoms to the treatment. The diagnostic tables are of great assistance.

A feature is the inclusion of sections on clinical laboratory work, gynecology, dermatology, and pediatrics. Even minor surgery and anesthesia are not forgotten. As a consequence, it is a sort of an encyclopedia of medicine, of moderate compass, yet very complete. A general practitioner would turn frequently to it for all sorts of information which would help him with his cases. The medico-legal aspects of fracture are given rather fully, and indeed the legal side of the doctor's responsibilities are mentioned in regard to many conditions and situations and safeguards suggested.

Here and there are statements which might be open to criticism, but they are of a minor character and do not detract from the general excellence. Complete, useful, and practical are three adjectives that are very appropriate to this excellent work on the practice of medicine.

VICTORY OVER PAIN, by *Victor Robinson, M. D.* 338 pages. Henry Schuman, New York, N. Y., publisher, 1946. Price \$3.50.

This is an interesting and attractively illustrated history of the discovery and development of anesthesia in its various forms from the

stone age club to our newest intravenous, intraspinal, and other anesthetics.

Of particular interest are the descriptions of mesmersion and hypotism in anesthesia. The discovery of a general anesthetic was the first great discovery made in medicine in the New World and produced a remarkable sensation among medical circles in Europe. It is of interest that chloroform as well as ether was developed in the United States, though first used by Sir James Simpson in Scotland.

The book is written in a clear and entertaining narrative style and can be read with pleasure by both layman and medical man. The illustrations, from interesting old sources, are a feature of the book.

THE CENTENNIAL OF SURGICAL ANESTHESIA, compiled by *John F. Fulton, M. D.* and *Madeline E. Stanton, A. B.* 102 pages; 8 illustrations. Henry Schuman, New York, N. Y., publisher, 1946. Price \$4.

This is a catalogue of the books and pamphlets relating to the early history of anesthesia exhibited at the Yale Medical Library in October 1946. The notes by two noted medical bibliographers are of great value and interest and form a kind of informal history of surgical anesthesia.

Another publication by Henry Schuman is a reprint in pamphlet form of W. T. G. Morton's *Memoir on Sulphuric Ether* first published in 1847. This has a foreword by Dr. Fulton and is Publication No. 14 of the Historical Library, Yale Medical Library. It contains 24 pages and is bound in an attractive cover. These works make an admirable supplement to Dr. Robinson's book, "Victory Over Pain," and constitute a real seminar on the history of anesthesia.

PHARMACOLOGY AND THERAPEUTICS, by *Arthur R. Cushny, M. A., M. D., LL. D., F. R. S.*, late Professor of *Materia Medica and Pharmacology in the University of Edinburgh*. 13th edition thoroughly revised by *Arthur Grollman, A. B., Ph. D., M. D., F. A. C. P.*, Professor of Medicine and Chairman of the Department of Physiology and Pharmacology, the Southwestern Medical College; and *Donald Slaughter, B. S., M. D.*, Dean of the Medical School, University of South Dakota, formerly professor of Pharmacology and Chairman of the Departments of Physiology and Pharmacology, the Southwestern Medical College, Dallas, Tex. 868 pages; 74 illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1947. Price \$8.50.

This book is one of the classic texts of pharmacology. First printed in 1899, it has been one of the few scientific works on the subject with a truly critical attitude. The first eight editions were prepared by Dr. Cushny himself. All too frequently a great textbook is ruined by its editors after the author relinquishes the task of editor. This has not been the case with Cushny's book and the editors have kept it up to date with as little alteration as possible as to style and method.

The changes in chemotherapy, vitamins, and endocrinology are the ones given prominence due to the marked advances in these fields.

The new antibiotics are dealt with as adequately as the knowledge of them permits. The various quinine substitutes receive great attention. The book is not an encyclopedia of drugs and their action, however, but is designed as a textbook for medical students and as a manual for doctors which will give the necessary facts on the action and use of drugs of all types. As such, this edition maintains the high reputation it has always had among medical men everywhere in the world.

THREE UNPUBLISHED DRAWINGS OF THE ANATOMY OF THE HUMAN EAR, by the late *Max Brodel*, assisted by *P. D. Malone*, *Stacy R. Guild*, and *S. J. Crouce*. W. B. Saunders, Co., Philadelphia, Pa., publishers, 1946.

In a simple and beautiful binding these hitherto unpublished drawings of one of the masters of medical illustration have been issued by the W. B. Saunders Company. Max Brodel was not only a great artist but one of his contributions to modern medical art was his insistence on making his drawings only from nature. To quote from the introduction to this collection of drawings, "that the advance of knowledge in many fields had been seriously retarded by copying from others." A fine colored portrait of Brodel forms a frontispiece. A note states that permission to reproduce these drawings in scientific and medical publications will be freely given upon request. The whole forms a fine tribute to a great medical artist.

PERIPHERAL VASCULAR DISEASES, by *Edgar V. Allen, B. S., M. A., M. D., M. S. in Medicine, F. A. C. P., Division of Medicine, Mayo Clinic, Associate Professor of Medicine, Mayo Foundation, Graduate School, University of Minnesota; Diplomat of the American Board of Internal Medicine; Nelson W. Barker, B. A., M. D., M. S. in Medicine, F. A. C. P., Division of Medicine, Mayo Clinic, Associate Professor of Medicine, Mayo Foundation, Graduate School, University of Minnesota; Diplomat of the American Board of Internal Medicine; and Edgar A. Hines, Jr., M. D., B. S., M. A., M. S. in Medicine, F. A. C. P., Division of Medicine, Mayo Clinic Associate Professor of Medicine, Mayo Foundation, Graduate School, University of Minnesota; with Associates in the Mayo Clinic and Mayo Foundation.* 871 pages; 386 illustrations, 7 in color. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$10.

The authors, in their new book, present thoroughly and clearly a difficult subject about which there is considerable lack of clear understanding in the field of peripheral vascular diseases. The material is based chiefly on the experiences of the authors and their colleagues at the Mayo Clinic and, as the authors state, they did not hesitate to express their own opinions on controversial points, particularly with regards to therapy.

The book is divided into 31 chapters, each of which covers a distinct phase of peripheral vascular disease and its management. The chapters are well organized and include a historical introduction of

the topic, anatomy, physiology, differential diagnosis, treatment, charts and tables, etc., and an excellent list of references at the end. Included in the list of chapter subjects is a definition of terms involved in discussing vascular diseases, a brief review of peripheral blood vessel anatomy, special methods of examination and diagnosis, and two chapters on the medical and surgical treatment of peripheral vascular diseases. Hypertensive disease and vascular diseases of the central nervous system were not considered to fall within the scope of this book.

The book is well written and the subject matter is complete and well presented without being too wordy and detailed. It contains 871 pages and 386 illustrations, 7 in color. The paper used is not too glossy, of good quality, and the print of a size not tiring to the eyes. It is recommended to the student interested in historical development, physiology, pathology, and methods of investigation in peripheral vascular disease; to the surgeon and internist for its completeness in diagnosis and therapy; and to others who must, by self-instruction, master this subject.

CLINICAL ELECTROCARDIOGRAPHY by *David Scherf, M. D., F. A. C. P., Associate Professor of Medicine, New York Medical College*; and *Linn J. Boyd, M. D., F. A. C. P., Professor of Medicine, New York Medical College*. Second edition. 243 illustrations, 267 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers. Price \$8.

The second American edition of this well-known work has been completely revised and rewritten. It differs from the usual atlases of electrocardiography in that there is a greater proportion of written material and fuller discussion of the mechanism of the phenomena considered. In doing this, however, the authors have still been able to include a sufficient number of illustrative tracings to cover important patterns without going into infinite variations.

The book is divided into four parts, the first of which covers theory and methods of electrocardiography. The discussions as a whole are good; however, the controversial nature of certain phases is not sufficiently stressed. The differences between tracings taken with a string galvanometer and those taken with amplifying apparatus are emphasized.

The second part takes up alterations of the ventricular complex and their significance. In chapter 16, on exercise test in diagnosis of coronary stenosis there is no mention of the important contributions of Master or of those of Levy. The discussion of chest leads is meager and there is no mention of unipolar leads. The parts in which are considered the effect of respiration and change in position and pathological changes in voltage are particularly good. There are thorough discussions of bundle branch block, digitalis effect, ventricular hypertrophy and Q-3.

Part 3 covers disturbances of stimulus formation and conduction. There is an excellent discussion of the effects of auricular fibrillation on the circulation. Other good discussions are on paroxysmal tachycardias, atrio-ventricular rhythms, interference dissociation, parasystole, and Bundle of Kent.

The final part, titled "Selected Problems in Interpretation," is devoted to differential diagnosis of myocardial damage and arrhythmias. This part is rather short considering the importance of the subject.

The bibliography is complete, however there are no reference numbers in the text. The illustrations are adequate and the arrangement of the text makes for ease of reading.

PRINCIPLES OF HEMATOLOGY, by *Russell L. Haden, M. A., M. D., Chief of the Medical Division of the Cleveland Clinic, Cleveland, Ohio; formerly Professor of Experimental Medicine in the University of Kansas School of Medicine, Kansas City, Kans.* 3d edition. 366 pages; 106 illustrative cases; 167 illustrations including 173 original photomicrographs and 95 original charts and drawings. Lea & Febiger, Philadelphia, Pa., publishers, 1946. Price \$5.

Dr. Haden's revised book on the Principles of Hematology is well named. He presents a very lucid, dynamic picture of the pathophysiologic mechanisms of hematopoiesis. All phases are well covered in the text and amply illustrated with superior photographs and excellent original diagrammatic sketches of the interrelationships of the peripheral blood, blood forming tissues, and gastro hepatic control. Following the normal mechanisms each pathologic state is taken up separately and by graphic means the derangement of the normal mechanism is clearly shown. Concomitantly the appropriate therapy becomes apparent. The book ends with a neat clinical classification of the dyscrasias and illustrative case histories that demonstrate diagnosis, pathologic physiology, and therapy.

This small, easily read book is considered very appropriate reading for all medical officers in the military service and for those connected with the atomic energy industries, for the ionizing radiations of atomic bombs and atomic fission in general have their earliest and most marked effect upon the blood. Careful study of this book will make the changes and their management more understandable.

RENAL HYPERTENSION, by *Eduardo Bruan-Menendez, Juan Carlos Fasciolo, Luis F. Leloir, Juan M. Munoz, and Alberto C. Taquini, Institute of Physiology, Faculty of Medical Sciences and Institute of Cardiology, V. F. Greg Foundation, Buenos Aires, Argentina.* Translated by *Lewis Dexter, M. D., Harvard Medical School, Boston, Mass.* 451 pages; numerous illustrations, one color plate. Charles C. Thomas, Springfield, Ill., publisher, 1946. Price \$6.75.

This book is a presentation in the English language of the first edition of the work by translation from the original as published by

the authors and investigators at the Institute of Physiology at Buenos Aires, Argentina.

The book is written from the scientific, experimental, and investigatory standpoint in a field wherein there is much to be done, and was first published in its first edition in 1943. Advances since that time are included in this English edition.

There is a general discussion of the technique and methods of use of certain substances and procedures for the production of permanent hypertension in laboratory animals, and an evaluation of the results obtained. The findings in connection with already existing conditions producing or contributing to hypertension are also stated and evaluated. There is an analysis of the work of other investigators in the field in general.

Several chapters are devoted to the substances, renin hypertensinogen, hypertension and their effects and the influence of the endocrine glands.

Several chapters discuss hypertension in man with a consideration of the possible origin and cause.

The presentation of the subject is clear and instructive and well worth attention.

Medical and surgical treatment of hypertension of renal origin is covered at some length and detail.

At the end of the book there is a bibliography containing 1,238 references.

The volume is one of interest chiefly to scientific investigators.

OPERATIVE GYNECOLOGY, by *Richard W. Te Linde, M. D., Professor of Gynecology, John's Hopkins University and Chief Gynecologist, John's Hopkins Hospital.* 751 pages; 309 illustrations in black and white and 15 subjects in full color on 9 plates. J. B. Lippincott Co., Philadelphia, Pa., publishers 1946. Price \$18.

In this new book, the author has done well in bringing the subject of operative gynecology up to date and making available the recent information on that subject. He describes the usual and some of the rarer gynecological operative procedures, and includes pre- and post-operative care of patients based on the author's house service at the John's Hopkins Hospital. He also gives the indications for and against operations and discusses the gross and microscopic pathology as it applies directly to the surgical problem under consideration. There are other interesting subjects, such as tubal diseases, sterilizations, and abortions, a chapter on chemotherapy, etc., and one on the technique of peritonoscopy.

The author believes that all gynecologists should have, not only a comprehensive training in gynecology, but in other subjects as well. Therefore, he has correlated a number of subjects such as female

urologic conditions, endocrinology, psychology, psychiatry, gynecologic pathology, and others. He points out that in order for the gynecologist to review these subjects, it was necessary for him to look through many other volumes before this information was found. Thus the author has condensed into one volume much material which is usually found in other books.

The author has differed too, from the usual conventional form in writing a medical text, in that he goes beyond the gynecological field and includes other specialties as well, because he believes that the gynecologist should also know some of the pitfalls resulting from a pre-operative mistake in diagnosis so in order to teach the reader how to take care of other surgical conditions in the lower abdomen, he has included some of the commoner conditions found by such a mistake, or as the result of a post-operative complication. These subjects include techniques for intestinal obstruction, enterostomy, lateral anastomosis, the operation of mikulicz, hernias, surgical conditions of the urethra, anus and rectum, and operations for urinary incontinence.

The book is exceptionally well illustrated with 309 halftones and zinc etchings. In the chapter on ovarian tumors, there are 15 colored illustrations that are exceptional. The book is well indexed, print of a good size, and the paper not too glossy.

This book should prove valuable to the student, the specialist, and to the practitioner, who by self-instruction must learn a certain degree of operative skill.

TEXTBOOK OF GYNECOLOGY, by *Arthur Hale Curtis, M. D., Professor and Chairman of the Department of Obstetrics and Gynecology, Northwestern University Medical School.* 5th edition. 755 pages; 455 illustrations, 36 in color. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$8.

In this book of 56 chapters the author has gone into a meticulous revision of the greater part. The section on anatomy remains essentially the same as in previous editions. The section on endocrines has been extensively revised, but there still remain some statements which might be considered out of date in the light of more recent work. Such a condition is unavoidable due to the rapid progress which is being made in the study of the endocrines. This section, all in all, is very excellent for a textbook. The section on ovarian tumors has been revised and much has been added making this section one of the best of its kind available. Additions have also been added to the section on other tumors of the uterus. A complete revision has been given the section dealing with gonorrheal infections, and the use of penicillin has been incorporated.

Revision of other sections of this volume, while not as drastic as those mentioned, are sufficient to bring the text completely up to date.

The illustrations are quite well done and are largely originals from the author's own cases. The photographs and microphotographs have been well-chosen and add much to the understanding of the pathology described.

Doctor Curtis has included every aspect of the subject of Gynecology and has given the profession not only an excellent textbook, but an excellent reference book for any gynecologist's office.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



ROUTINE PHOTOFLUOROGRAPHIC EXAMINATIONS OF NAVAL AND MARINE CORPS PERSONNEL: END RESULTS

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Six years ago the Navy began the use of routine roentgenographic examinations of the chest to detect evidence of pulmonary tuberculosis and of other disease in recruits, evidence of which appears on the x-ray film of the chest. Wherever possible the examinations were made with 35 mm. photofluorographic equipment. As its value in the detection of intrathoracic defects became evident, its use was expanded to include all Navy and Marine Corps personnel as part of the physical examination to determine fitness for enlistment, appointment, and at annual intervals while on active duty (1). During the period July 1944–October 1946, 5,698,728 photofluorograms were recorded of which 01.6 percent showed evidence of tuberculosis and 0.05 percent revealed findings of other significant defects. This interval includes the later months of the war and the demobilization period.

In March 1944 a review was begun of the records of Navy and Marine Corps personnel whose diagnosis of pulmonary tuberculosis had been established by boards of medical survey, a preliminary report of which was recently published (2). To date 1,843 cases of pulmonary tuberculosis have accumulated in which the diagnosis was established during the study of personnel hospitalized because suspicious findings had been noted in photofluorographic films and confirmed in 14 x 17 inch films. Analysis of this group of cases appears to shed some light upon the end result of tuberculosis case-finding by means of routine x-ray examinations, and is presented in the following tables. Unfortu-

nately, it is not possible at this time to correlate the information disclosed with the total number of routine examinations made during the period.

Table 1 shows the result of 1843 positive photofluorographic tuberculosis examinations taken over a 2-year period (April 1944–March 1946) during the late war and early postwar period.

It may be noted that there is a larger percent of officers than enlisted personnel in the more advanced forms and, of course, the reverse is true for the minimal group. Approximately 33 percent of the enlisted are classed with moderate and far advanced forms while about 41 percent of the officers are thus listed. This difference would be accounted for by chance less than 5 times in 100. These differences may also be seen in the subtable where it is shown that there is a larger ratio of officers. 15.3 percent, in the moderate and far advanced group than among the minimal cases, 11.7 percent.

TABLE 1.—*Number and percent of medical surveys for tuberculosis resulting from photofluorogram examinations of Navy and Marine Corps personnel, April 1944–March 1946*

Form of pulmonary tuberculosis	Personnel					
	Number			Percent		
	Total	Enlisted	Officers	Total	Enlisted	Officers
All cases.....	1,843	1,607	236	100	100	100
Primary, active and healed.....	106	96	10	5.8	6.0	4.2
Reinfected, minimal, active and arrested.....	1,108	978	130	60.1	60.8	55.1
Reinfected, moderate, active and arrested.....	580	491	89	31.5	30.6	37.7
Reinfected, far advanced, active and arrested.....	49	42	7	2.6	2.6	3.0

Ratio of enlisted personnel to officers

	Total	Enlisted	Officers
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Minimal.....	100	88.3	11.7
Moderate and far advanced.....	100	84.7	15.3

While table 1 includes both active and arrested cases, of course the epidemiologist is primarily concerned with the men having active lesions. Therefore, table 2 is presented to show the distribution of only the active cases.

When all of the cases were considered in table 1, it was shown that approximately 60 percent were classified as minimal, while in table 2 it may be seen that only about 37 percent of the total active cases are so classified. The reason for this reversal or shifting was the fact that a large percentage (59) of the moderately and far advanced cases were diagnosed as being in the active form while only approximately 20 per-

TABLE 2.—*Number and percent of active cases of pulmonary tuberculosis discovered by photofluorograms of Navy and Marine personnel, April 1944–March 1946*

Personnel	Form of pulmonary tuberculosis									
	Number					Percent				
	Total	Pri- mary	Mini- mal	Mod- erate	Far ad- vanced	Total	Pri- mary	Mini- mal	Mod- erate	Far ad- vanced
All active cases.....	602	6	225	327	44	100	1.0	37.4	54.3	7.3
Enlisted.....	520	5	199	279	37	100	1.0	38.3	53.6	7.1
Officer.....	82	1	26	48	7	100	1.2	31.7	58.6	8.5

cent of the minimal cases were judged to be in the active stage. This difference was constant for both officers and enlisted personnel. The distribution of active cases discovered through photofluorograms is not entirely in accord with other similar studies (3) (4) and leads one to suspect that perhaps routine chest examinations may not shift the majority of tuberculosis findings to primary and minimal forms when only active cases are considered. It should be pointed out that the differences (although not statistically significant) of the distribution between officers and enlisted personnel by the severity of the findings is still present when only active cases are considered. Only 60.7 percent of the enlisted personnel were classified as having a moderate or far advanced form as contrasted with 67.1 percent of the officers. It would appear, from the results of the present study, that mass x-raying discovers large numbers of minimal cases, which upon further observation and examination prove to be healed or arrested.

Figure 1 presents the photofluorogram findings for officers and enlisted men by length of service for all cases, active and arrested. As was previously mentioned in comments relating to table 1, a larger ratio of officers to enlisted men was found in the more advanced forms. Therefore, as might be expected, figure 1 shows that the officers, as a group, had a longer length of service than had the enlisted personnel at the time of original detection.

Only 8.1 percent of the officers' cases were discovered before they had been in the Navy 4 months. However, approximately 1 out of 5 or 18.6 percent of the total of 1,607 cases were detected among enlisted men having been in service for only this short period of time. Furthermore, when longer periods of time are considered, the contrast becomes even more evident. Approximately, 35 percent of the officers had service records of 4 years or longer and among the enlisted personnel only 12.6 percent had been in the Navy over 48 months. These differences are highly significant and it is quite evident that there are certain forces other than chance that are accounting for them. Of course it is

COMPARISON OF LENGTH OF SERVICE OF ALL OFFICERS AND ENLISTED PERSONNEL WITH POSITIVE PHOTOFLUOROGRAPHIC FINDINGS

APRIL 1944 - MARCH 1946

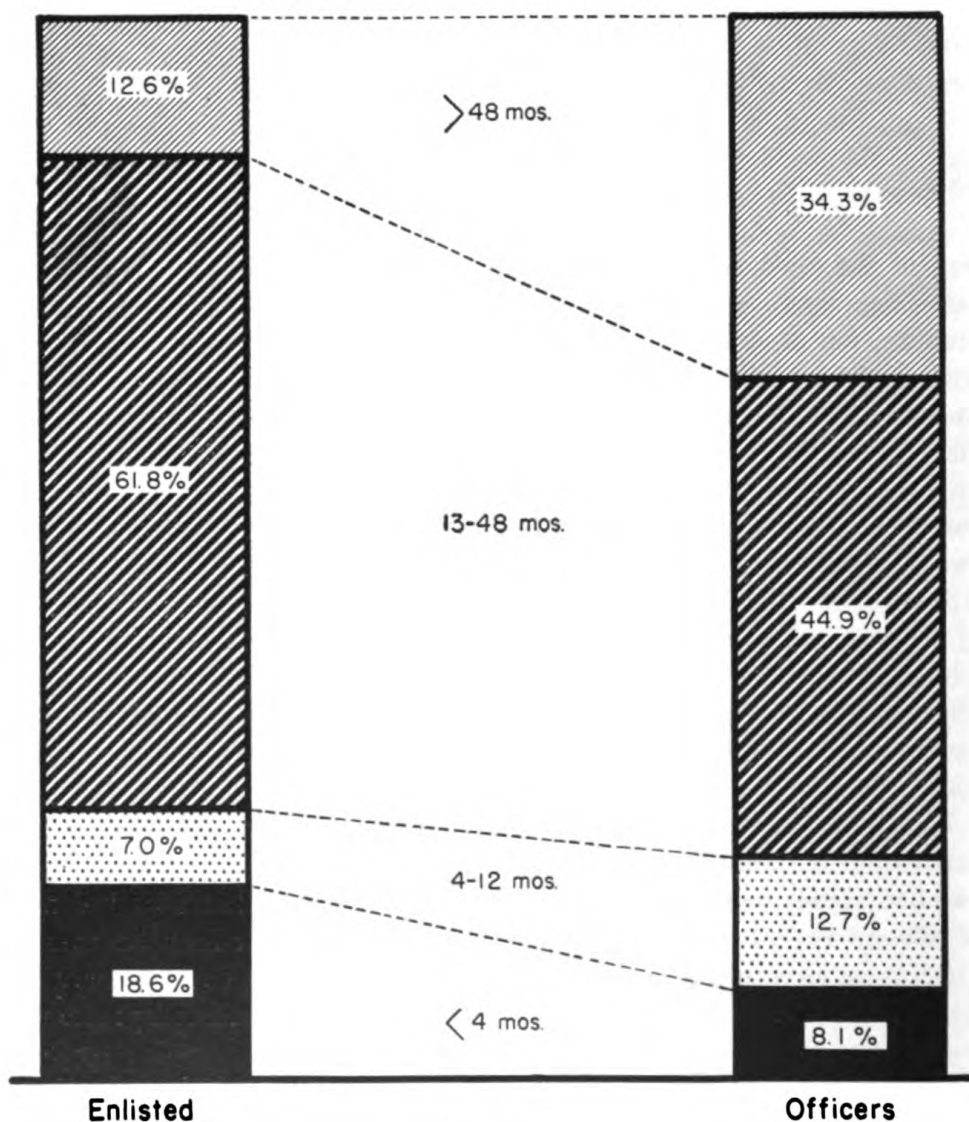


FIGURE 1

quite possible that the officers, under the present tuberculosis control program, are not being examined as often as are the enlisted men.

Figure 2 is presented in order to show the distribution of only the active cases by length of service. It may be seen at once that there is very little difference in distribution as compared to figure 1—this confirms the findings relating to length of service, mentioned above, even when active cases only are considered. In other words the length of

service factor seems to be related to the severity of the disease and the percentage of officers included in the study having a service record over 4 years is significantly greater than for enlisted personnel for either the active or arrested cases.

COMPARISON OF LENGTH OF SERVICE OF ALL OFFICERS AND ENLISTED PERSONNEL WITH POSITIVE PHOTOFLUOROGRAPHIC FINDINGS OF ACTIVE CASES

APRIL 1944 – MARCH 1946

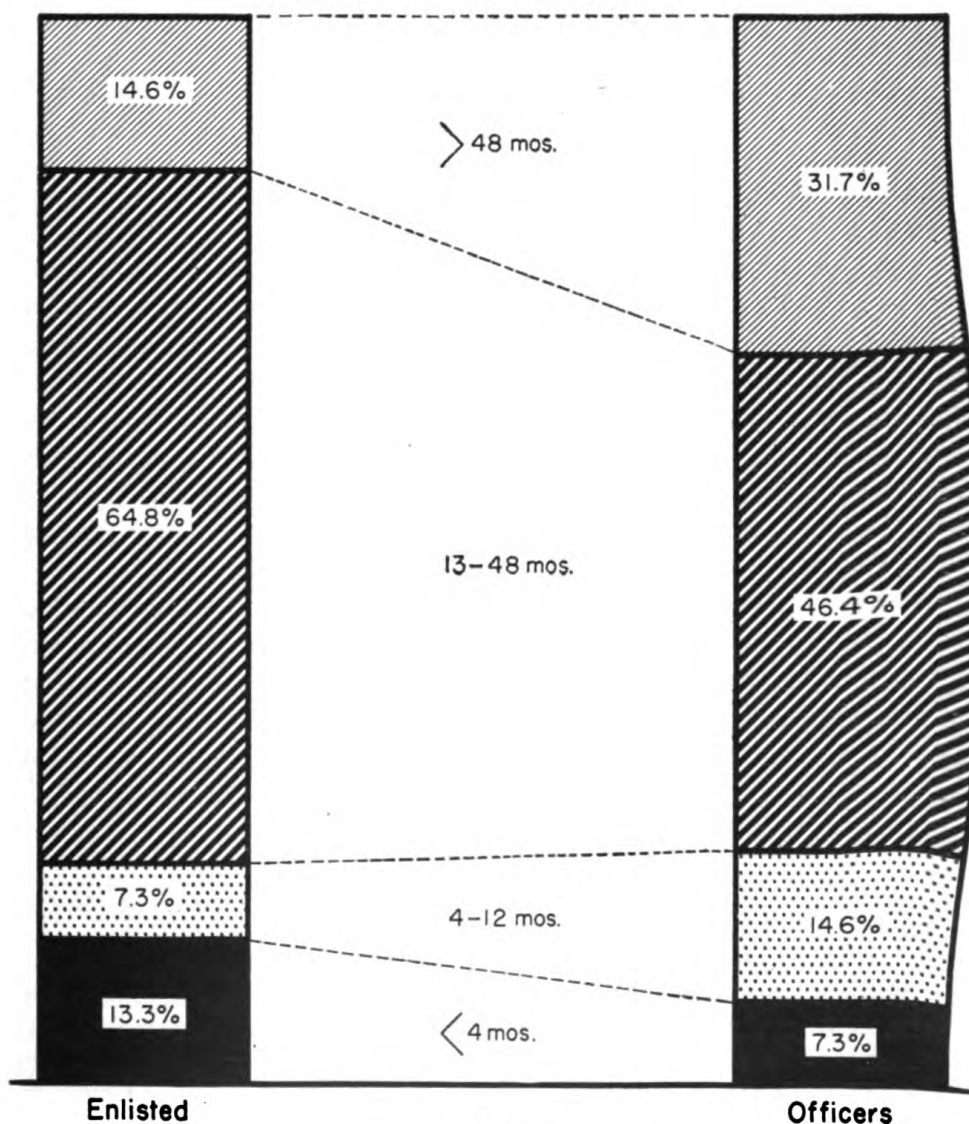


FIGURE 2

TABLE 3.—*Number of Navy personnel with positive tuberculosis findings by length of service and form of tuberculosis*

Form of pulmonary tuberculosis	Length of service									
	Enlisted					Officers				
	Total	<4 months	4-12 months	13-48 months	>48 months	Total	<4 months	4-12 months	13-48 months	>48 months
All cases.....	1,607	299	113	993	202	236	19	30	106	81
Primary, active, and healed.....	96	42	13	37	4	10	0	3	3	4
Reinfected, minimal active, and arrested.....	978	148	56	664	110	130	11	15	59	45
Reinfected, moderate active, and arrested.....	491	104	43	263	81	89	8	11	42	28
Reinfected, far advanced, active, and arrested.....	42	5	1	29	7	7	0	1	2	4

DISCUSSION

From the above it appears that the diagnosis of pulmonary tuberculosis has been discovered somewhat earlier in their careers and in somewhat less advanced forms among enlisted men than among officers. This may be due in part to a more uniform x-ray screening of the former when their naval careers began, and possibly, to more frequent reexaminations subsequently.

The large number of cases discovered after years of active service attests to the need for periodic chest x-ray examinations of all personnel over a long period. A screening examination at the time of entering upon active duty will not suffice to ensure a Navy free of tuberculosis.

It also appears that in mass x-ray operations a considerable number of minimal lesions are discovered which upon further observation appear to be without present clinical significance. It is recognized that subsequently some cases become active; therefore, this group of individuals must be reexamined more frequently than others in order that any changes in their apparently stable lesions may be quickly noted.

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A CRITIQUE OF TUBERCULOSIS CONTROL

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Tuberculosis is still one of the important causes of death. According to the United States 1940 census it rated seventh with 45.9 deaths per 100,000 population.

In 1944 it was reported as the cause of 54,731 deaths, or 4 percent of all deaths in all age groups. More recently Foley and Andosea report the presence of 500,000 cases in the United States, with an average of 60,000 deaths due to tuberculosis every year (1). It is the leading cause of death between ages 20 to 40.

In the United States Navy it remains an important disease. In the medical statistics of the calendar year of 1942 there were 482 admissions for tuberculosis which were considered contracted in the service, however, there were 2,290 cases which were considered to have existed prior to enlistment, making a total of 2,372 cases of tuberculosis (of this the pulmonary forms comprised 92.53 percent of these admissions). The mortality rate was 3 per 100,000 but this is of no significance, and probably is higher due to the number of individuals surveyed out of the naval service with this disease.

Tuberculosis is thus a very major cause of disease and death. It is of a great economic consequence in civilian life to the individual, but in the naval service it can be easily investigated and treated without loss economically. It is the ideal situation for a patient with a chronic disease.

The mobile units of the Navy are doing an excellent and productive task and accomplishment in case finding. Thousands of naval personnel are being x-rayed and individuals are being discovered with pulmonary lesions. Surveys, such as these, find but do not necessarily identify the disease. The proper identification and successful treatment of these early forms of intrathoracic disease demand serious attention.

Tuberculosis should be suspected at any age, in any occupation, and with any type of social or economic background. Of a series of 200 patients, with minimal lesions consecutively admitted to Otisville Sanatorium 45 were over 35 years old, and 20 more were older than 40 (2). Likewise, Myers (3) has pointed out that tuberculosis mortality is higher after the age of 50 years than at any other time in life. In this respect, not only may the current case-finding method in the United States Navy miss some cases of tuberculosis, but likewise carcinomas of the lung and certain mediastinal tumors will be undiscovered early when treatment is more effective. Thus, mass photo-fluorographic surveys should include all personnel, no matter what

their age, sex, or rank. There is too, no reason why mass chest x-ray surveys cannot include naval dependents on occasions. This would be of definite tuberculosis control value to naval personnel, and of value to the Navy itself, for it cares medically for naval personnel. Community health would also be safeguarded by this procedure.

It has been the good fortune of the author to be in two surveys made at two naval air stations where, respectively, there were 0.24 percent proved cases from 3,226 x-ray examinations, and 12 cases of suspected lesions from 2,214 cases. But the subsequent follow-up in these latter cases is a great contrast. At the one activity, prolonged and exhaustive clinical studies were made on the first group whereas the other group was studied by hasty methods.

With the excellent tuberculosis control program set up by the United States Navy Medical Department, it is very unfortunate that the inestimable value of the whole program is destroyed in some respects. The nullifying effect comes from the management of the cases picked up on the survey. There is evidence that the danger and the immediate threat of such lesions are too little appreciated, and are to be regarded as potentially progressive until proved otherwise (4) (5) (6) (7) (10). Too often the medical officer follows a policy of waiting with reassurance of the patient, and advises a recheck x-ray in a few months. Essential time of treatment on discovery is lost by such procedures for the percentage of arrested or healed cases is highest, and the time required to obtain an arrest of the disease is much shorter in minimal cases. Minimal cases have fewer recurrences (2). Roentgenologists often exert ill influence in this respect, and too often the clinician without his feet on the ground relies strongly on the opinion of the x-ray man. Frequently, the x-ray man advises a check-up in a few months. This waiting policy often results in the check-up film revealing that a minimal tuberculosis focus has developed into moderately advanced or far-advanced disease.

The roentgenologist errs again in another way by giving his opinion that the lesion under question is an "arrested lesion." He unduly influences the medical officer with little experience in tuberculosis. However, final diagnosis should never be made from x-ray shadows, since first it may be due to another disease process (9) and furthermore one cannot tell whether it is an early or old focus by its roentgenological appearance alone (5) (6). This cannot be emphasized strongly enough, especially since many of the cases found in the naval service have had several years' service, usually with previously reported negative chest x-rays.

On the other hand, however indiscriminate diagnosis of pulmonary tuberculosis is not to be made a basis of x-ray examination alone. Approved sputum tests, gastric lavage cultures, and the tuberculin test

should all be employed. If diligent search and study reveal no tubercle bacilli then these cases ought to be called "suspicious tuberculosis." These cases then should be followed for several years—pulmonary tuberculosis should not be diagnosed on an x-ray film alone (11).

Experience with tuberculosis shows that early infiltrates are sometimes of such a small extent as to be overlooked. However, the characteristic of the roentgenologic shadow per se cannot be a guide to its stability. Often minimal lesions may possess circumscribed or a stringy appearance, which could be interpreted as an old fibrotic process. Such a view is dangerous. For these may very well be active lesions.

Serial films over a period of weeks, careful temperature records, differential white cell counts, erythrocyte sedimentation tests all have value in determining whether a lesion is progressive or stable. Too often there is the tendency to diagnose tuberculosis by short-cut and sometimes slipshod methods.

It has been noted that cases discovered by a mobile photofluorographic unit have been admitted to naval hospitals, and after a brief study have been declared arrested cases (the second group mentioned above). These cases do not appear to have been given an exhaustive enough study, only one criterion appears to have been stressed in their study by the attendants.

The following case reports are presented to illustrate the improper and the proper methods of evaluation of chest lesions.

CASE REPORTS

Case 1.—A 24-year-old lieutenant in the Chaplain Corps presented himself on 22 March 1946, because of fatigue and slight stiffness of the ankles. Both ankles appeared to be swollen during the day but this disappeared with rest at night.

The past history was negative. The family history revealed only that his paternal grandfather had arteriosclerosis with swollen glands of his right neck and edema of his ankles. The rest of the immediate and distant relatives appeared to be well.

Physical examination revealed a well-developed male who appeared well. Temperature 98.6° F., pulse 76, respiration 18. There were no abnormal findings. Laboratory work-up revealed: Red blood cells 4.2 m., hemoglobin 12.0 gm., white blood cell 10,000 with 70 percent segmented neutrophils, 3 percent bands, 22 percent mature lymphocytes, 4 percent monocytes, 1 percent eosinophils. Sedimentation rate was 8 mm. in 1 hour. Urinalysis revealed a specific gravity of 1020, with a 1 plus albumin, a negative sugar reaction and the microscopic revealing 32 leukocytes (high-power field). A blood Kahn was negative.

A chest x-ray plate was read as negative (however, on subsequent examination a small lesion was noted in the second right interspace). (See fig. 1.)

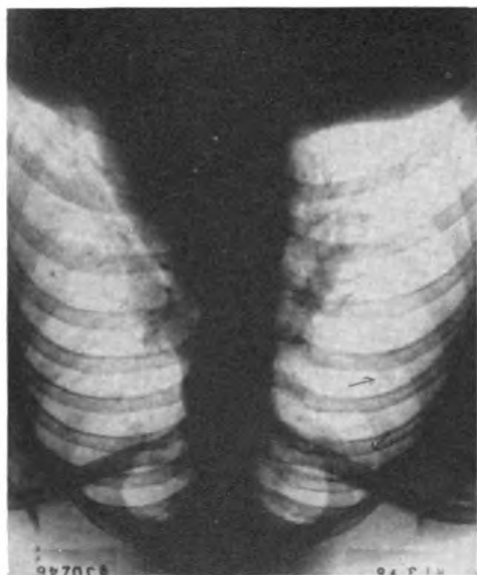


FIGURE 1.—Case 1. The first lesion appearing in this case is seen in the second right anterior interspace.

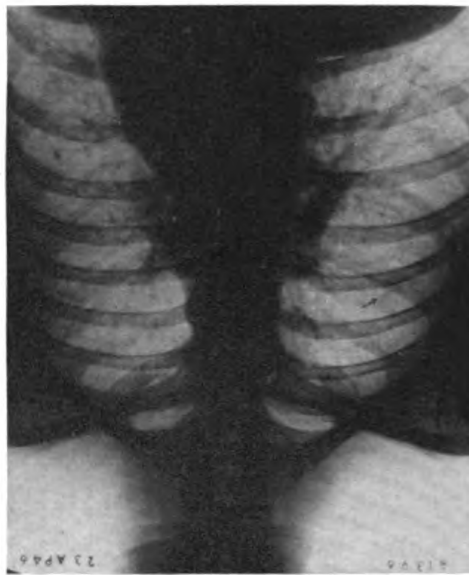


FIGURE 2.—Case 1. Taken 2 months after figure 1 and showing a dense lesion in the right first interspace anteriorly with a similar lesion present in the second anterior right interspace.

His symptoms were interpreted as due to a pyelonephritis by the attending medical officer and his subsequent course under sulfonamide therapy revealed clearing of the urinary findings and disappearance of all symptoms. He was discharged to duty on the eighth hospital day.

Two months later he consulted the attending medical officer just prior to his separation from the naval service. He was assured that he was well, and an x-ray of his chest was taken to hasten his separation. This x-ray plate revealed an area of density in the first right interspace, and a smaller area in the second right anterior interspace with fibrotic strands extending from it (this latter lesion is the area which was considered suspicious on review of the first plate taken in March 1946). (See fig. 2.)

In view of these x-ray findings observation and further study were thought advisable. Because there were no facilities available at the dispensary, he was transferred on 16 August 1946 to a naval hospital. Here a further chest x-ray plate (stereoscopic) was reported "—— reveals a rather dense shadow in the first interspace peripherally on the right side with a few strands in the right paravertebral area. There is also a small calcification in the mid-portion of the left lung field with a few scattered calcifications in the hila. The heart and diaphragms are normal. Impression: The findings are suggestive of old healed pulmonary pathology but follow-up films are suggested at a later date." His hospital course revealed no abnormal physical or laboratory findings. He was permitted to be ambulatory. One blood count, one sedimentation rate, and one sputum examination were performed (regarding this see Comment). He was then discharged on his sixth hospital day and told he had no disease. A statement placed in his Health Record "Patient has no clinical, laboratory, or roentgenologic evidence of active tuberculosis."

COMMENT

This patient had an active pulmonary lesion as revealed by his serial x-rays. One sputum was secured and examined by direct smear. On questioning the patient it was found that this was postnasal drippings. No attempt was made to rule out activity of the lesion and furthermore no attempt was made to discover whether this was of a tuberculous nature or some nontuberculous condition. This case certainly was not evaluated. Here, too, is a patient with a negative x-ray on entry into the service just 1 year ago, and now has a lesion which should warrant some more complete study than that given.

Case 2.—A 24-year-old WAVE lieutenant (jg) was feeling under par and consulted a medical officer. A physical examination was done on 20 August 1946 and was considered normal. A chest x-ray was done and a dense shadow was seen in the left sixth interspace which was reported as an arrested lesion. The patient was told that she was overworked and that some leave and recreation would cure her.

Her symptoms continued and on a separation x-ray plate of the chest about 3 months later a tuberculous cavity with infiltration was discovered in the left lung.

COMMENT

Reliance on a roentgenologic opinion concerning the activity of the lesion as done in this case is to be condemned. No clinical evaluation was attempted. Tuberculosis consciousness was not present. This patient on discovery of the lesion in the first plate should have been admitted, and critically observed and studied.

Case 3.—A 22-year-old aviation ordnanceman, third class, was picked up by a mobile unit as having a lesion in the right apex in November 1944. The medical officer had a further x-ray made which was reported by the roentgenologist as a probably arrested tuberculosis lesion of the right apex. Further x-rays at a later date were advised. This man was allowed on the basis of these reports to duty on a combat vessel in combat engagements. On return at a reclassification center further x-rays made revealed an exudative lesion in the right apex. Further study and hospitalization revealed an active tuberculosis of the right apex. (See fig. 3.)

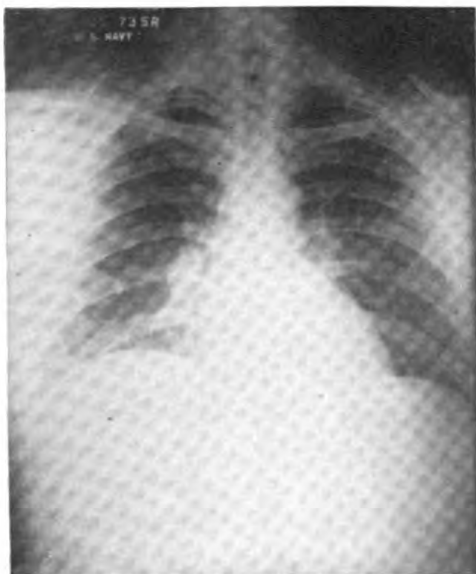


FIGURE 3.—Case 3. The lesion is noted in the right apex. This was considered by a roentgenologist to be an arrested lesion. Clinically this was shown to be an active lesion.

COMMENT

Here again no clinical evaluation of the case was attempted. The activity or inactivity of the lesion was never established. This man was definitely a hazard to his shipmates and certainly in a dangerous state to himself.

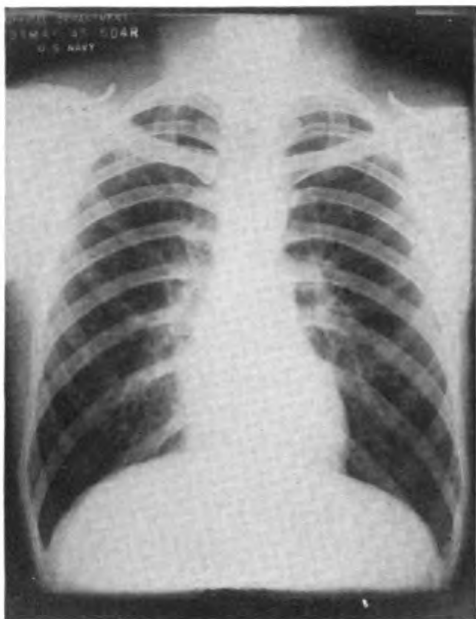


FIGURE 4.—Case 4. The lesion is visualized in the second right anterior interspace and a strandlike lesion is also seen in the first intercostal space.

COMMENT

This case was given a proper evaluation, showing the definiteness of clinical procedures. Reliance was not placed on one criterion to establish the activity or inactivity of the lesion, e. g., the x-ray reading. This was an early case of minimal tuberculosis which offers a better result on treatment.

Case 5.—A. D., a 20-year-old aviation machinist mate, second class, was found to have an area of infiltration in the third right anterior interspace, probably pulmonary tuberculosis. This was the finding of a mobile chest unit survey on 17 May 1945. The history revealed an antecedent cold about 2 weeks previously. There were no symptoms at the present time and no familial history of note. Physical examination and laboratory procedure were all normal. Search for acid-fast bacilli were negative. A recheck x-ray plate 2½ weeks later revealed complete clearing of the area of infiltration, so that a final diagnosis of atypical pneumonia was made. He was then discharged to duty. (See figs. 5 and 6.)

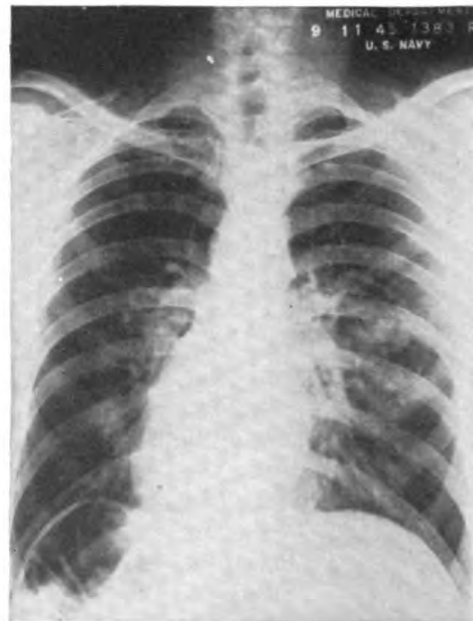


FIGURE 5.—Case 5. The chest x-ray shows areas of exudative densities in the right lung in the region of the third anterior interspace and overlying the fourth anterior rib.

COMMENT

Here was another case with x-ray findings in the chest that proved to be an atypical pneumonia after careful study and observation. A less careful work-up could possibly have labelled this patient a pulmonary tuberculosis. Some of the x-ray findings in atypical pneumonia have been reported as persisting for months.

Case 6.—E. G., a 52-year-old rear admiral, presented himself on 18 August 1946, complaining of fatigue, weakness, and some shortness of breath. Physical examination revealed no abnormal findings (by the attending medical officer). However, an x-ray of the chest revealed one infiltrative type of lesion, probably an abscess either of a tuberculous or malignancy origin. This later proved to be pulmonary tuberculosis.

COMMENT

This illustrated a case which if included in the chest photofluorographic survey program might have been discovered much earlier before symptoms occurred. A mobile unit was present at the station just 1½ months of the onset of his symptoms, and it is possible the lesion might have been visualized at that time. This illustrates the necessity of including all personnel no matter what their age.

DISCUSSION

Upon the recognition of a lesion in the lung, a policy of prompt treatment must be followed (2) (4) (5) (6) (7). Time is a dangerous threat to the patient with an intrathoracic lesion. Immediate and adequate care is necessary. In a study of mass survey made in California, it was discovered that no reduction in the incidence of far-advanced disease occurred among sanatorium admissions because such a small percentage of the discovered minimal lesions were admitted for study and treatment (12). A similar finding magnifying the need of absolute preventive rest cure in patients with minimal lesions until definite inactivity has been

established is shown by a study of 100 cases, where 34 percent of the lesions progressed when such a policy was not adhered to (13). That this is especially true for patients under 30 years of age is shown by the experience at Cornell University Hospital (7). The institution of treatment early is to be followed even when the patient is completely free of all symptoms or has only mild symptoms or like-

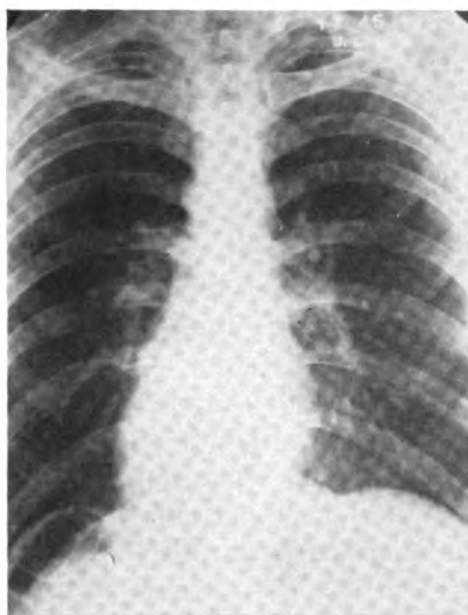


FIGURE 6.—Case 5. This was taken 2½ weeks after figure 5 and shows the complete disappearance of the densities noted in the previous film.

wise free of laboratory findings. The potentialities exist nevertheless. Lesions existing a long while may activate, and rest on first discovery may prevent such a catastrophe. In addition a lesion that roentgenographically appears innocent and stable, if not given prompt treatment may show instability or it may show regression on the rest routine showing that it was not what it appeared to be after all. In addition, reliance placed on serial roentgen-ray films is not entirely safe for a process may be active and yet may show no significant roentgen-ray change for a period of years (8).

A diagnosis of pulmonary tuberculosis is not to be made on incomplete evidence. Suspicious film findings are to be corroborated by a positive tuberculin test and by positive bacillary findings. Clinical study might likewise prove that the lesion is nontuberculous, e. g., atypical pneumonia, fungous infection, pneumoconiosis, etc. But studies of 1 week will be of no avail in determining whether this is a tuberculosis, active or inactive, lesion or a nontuberculosis condition. This time barely allows for the patient's admission to and discharge from a naval hospital.

This article is limited in its scope, and only brief mention will be made of the clinical studies necessary to determine the nature and activity of the lesion. These procedures should be done on every case, as a general rule, however, arbitrary judgment may be used. A careful record of the temperature during each day with the patient at rest. The results of this are obvious. The sputum is valuable, for to find tubercle bacilli establishes the diagnosis. Yet it must be emphasized that a positive sputum is not a prerequisite for diagnosis and a negative sputum does not necessarily rule out activity. However, if the sputum is exhaustively studied approximately 80 percent of cases with active minimal tuberculosis will yield positive sputa.

A concentration technique must be used; this increases the positive findings 30 percent. However, the best method is to use pooled specimens collecting them from 3 to 7 days, which will increase positive results. This should be repeated on several occasions. If these are negative then resource should be made to multiple cultures and guinea pig inoculation (the later being the best). If there is no sputum, or, if the secretions are not coming from the lungs, then concentrated gastric washings should be done, following a fast, and the contents *immediately* prepared for culturing or guinea pig inoculation (microscopic examination of the gastric content is of little value) (16). Cases with sputum consistently negative by the concentration methods will yield positivity for tubercle bacilli in 48.7 percent when the lavaged gastric contents are inoculated in animals (14).

White cell counts and differentials, and erythrocytic sedimentation rates may be of value in determining activity, but reliance on them is not to be great. For these may all be normal with a progressive lesion.

The x-ray is valuable in showing activity when careful serial films are made. Changes observed whether regression or progression indicate activity of the lesion. It is essential to realize that the shadows may show little change and still be a danger because of residual foci caseation. Complete healing takes months and often years.

A tuberculin test should be done on all cases in which tubercule bacilli cannot be obtained. If this reveals no reaction when repeated after an interval of 6 weeks and approved laboratory methods have revealed no tubercule bacilli this case is not tuberculous, and other chest conditions are to be searched for (16). (A certain number of persons with cachectic states or with overwhelming infection, e. g. miliary disease, etc., will not react to tuberculin. Certain diseases such as measles, depress tuberculin allergy markedly.)

Physical examination usually reveals no positive findings in minimal tuberculosis. Thus it is not of great importance. However, the findings of râles might suggest activity of the lesion.

The procedures last discussed for the evaluation of cases with suspected lesions discovered by mobile photofluorographic surveys, have been merely touched on; and a great deal of work, study, and conclusions have not been mentioned in order to limit the scope of this paper.

No discussion of treatment will be attempted.

It cannot be too strongly emphasized that all individuals with a minimal tuberculous lesion, without symptoms, abnormal physical findings, white cell differentials, or erythrocytic sedimentation rates, may have, and frequently do have, an early focus of disease with serious potentialities and represents an immediate threat.

Further, it is to be as fully emphasized that the evaluation of a pulmonary lesion is purely a clinical problem of careful study. No thorough clinician relies exclusively upon a solitary diagnostic aid, even when circumstances strongly tempt him to do so. It is our duty as medical officers to diagnose the greatest possible percentage of unsuspected cases of tuberculosis, to place these personnel under immediate and adequate care, to render them and the rest of the Navy safe from further spread of their disease, and to properly dispose of the personnel in accordance with existing directives.

There is a definite need for each naval hospital to have a tuberculosis specialist. He should either come from the Navy medical officers or else from the civilian consultants. It should be mandatory that he decide the evaluation program and disposition of all cases with suspected pulmonary lesions (15). This will be of value to the Navy for its tuberculosis control program to be more fully effective, and of definite value to the interest and welfare of the patient.

A tuberculosis education program should be started among the medical officers of the United States Navy, for it is apparent that the

full comprehension of the methods of evaluation and diagnosis is not present. This is also true of the general family physician (1) (11). The present type of medical school teaching tends to minimize the tuberculosis work.

A plea is made that all medical officers become "tuberculosis conscious," which fact will pay in the discovery and early treatment of minimal tuberculosis in which cases are received for the treatment results.

CONCLUSIONS

1. Tuberculosis, as a major disease, is mentioned as causing 60,000 deaths each year, and leading cause of death in the 20 to 40 age group. It is an important disease in the United States Navy.

2. The mobile photofluorographic units in case finding are discussed.

3. The methods of evaluation of the cases discovered by survey are discussed. It is pointed out that the full value of survey work will not be realized unless a proper disposition of all discovered lesions is made. The establishment of whether a lesion is active or inactive is emphasized as a purely clinical problem.

4. Illustrative cases are presented as examples of the methods of evaluation and the result of improper evaluation.

5. It is pointed out that with careful study the lesion may be proved to be nontuberculosis, which is valuable information to the patient.

6. The recommendation of a chest specialist at naval hospitals, with a mandatory procedure that all discovered cases come under his cognizance is made. The establishment of a tuberculosis educational program for medical officers is recommended.

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A REVIEW OF 283,225 CHEST PHOTOFLUOROGRAMS AT THE UNITED STATES NAVAL PERSONNEL SEPARATION CENTER, LIDO BEACH, LONG ISLAND, N. Y.

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INTRODUCTION

Chest 35 mm. photofluorograms were taken as a regular part of the physical examination for discharge of every enlisted man that passed through the separation center to ascertain the physical fitness of the men for discharge; 283,225 men were examined. The ages of the men extended from 18 to 65 years with the greater majority of them being between 18 and 23 years. The men were examined over a 10-month period starting 1 October 1945 and extending to 1 August 1946.

RESULTS

The results of this survey are summarized in table 1. There were 4,026 requests for 14 by 17 films made by the medical officers, or 1.42

*Resigned.

percent of the total number of films taken. After viewing these it was found necessary to send 397 of these 14 by 17 retake cases either to the hospital or the dispensary at the separation center, disqualifying the men as being not physically fit for discharge, and requesting further study and treatment of their tentatively diagnosed conditions. The 397 cases represented 9.86 percent of the 4,026 requests for retakes.

All the cases transferred to the hospital or the dispensary were transferred on the Navy diagnosis of "Diagnosis Undetermined" routinely, and the diagnoses were definitely established at the hospital or the dispensary.

TABLE 1.—*Total number of men examined and sent to the hospital for various causes due to x-ray findings: 1 October 1945 to 1 August 1946*

	Number	Percent of total
Total number of photofluorograms taken.....	283, 225	
Total number of 14 by 17 requests for retakes.....	4, 026	1. 420
Total number of men sent to the hospital and/or the dispensary.....	397	. 140

TABLE 2.—*Analysis of cases tentatively diagnosed as pulmonary tuberculosis*

	Number	Percent of grand total
Reinfection phase tuberculosis, minimal.....	248	0. 088
Reinfection phase tuberculosis, moderate.....	38	. 013
Reinfection phase tuberculosis, advanced.....	19	. 0067
Total tuberculosis cases.....	305	. 108

There were 305 cases sent to the hospital for reason of suspected pulmonary tuberculosis. This represents about three-fourths of the cases sent to the hospital and the dispensary. Table 2 shows our tentative x-ray diagnoses broken down into minimal, moderate, and advanced phases of tuberculosis. The remaining 92 cases are itemized in table 3. Fifty-nine of these cases or about 65 percent of the

TABLE 3.—*Analysis of cases tentatively diagnosed other than pulmonary tuberculosis*

	Number	Percent of grand total
Pneumonitis.....	59	0. 021
Bronchiectasis; question of.....	5	
Pneumothorax.....	5	
Metastatic tumor.....	4	
Mediastinal enlargement.....	4	
Pleurisy, acute.....	4	
Silicosis.....	3	
Cardiac enlargement.....	3	
Pleural effusion.....	2	
Cystic disease of the lung; question of.....	1	
Coarctation of aorta; question of (rib erosion visualized).....	1	
Hydropneumothorax (left lung).....	1	
Total.....	92	. 032

92 cases were diagnosed pneumonitis by x-ray. The majority of the pneumonitis cases were transferred to the dispensary at the separation center. As soon as these cases at the dispensary were cured the men were returned to the separation center for their discharge processing.

DISPOSITION OF THE CASES HOSPITALIZED

All cases sent to the hospital or the dispensary by the x-ray department at the separation center were followed up and checked on to ascertain the final diagnosis and the further disposition of the cases. The results of these findings are analyzed in tables 4 and 5. Table 4, part 1, shows all the cases with a proved diagnosis of tuberculosis, showing where and how they were taken care of for either further treatment or disposition. The U. S. Naval Hospital, Sampson, N. Y., has been designated as the naval hospital for the care of naval personnel with active tuberculosis. It was here that the majority of the proved cases of tuberculosis were sent. The positive diagnosis of tuberculosis was determined at U. S. Naval Hospital, St. Albans, N. Y., by additional x-rays, bacteriological study of gastric washings, bacteriological study of sputum, and the P. P. D. test for tuberculosis.

The U. S. Naval Special Hospital, Seagate, Brooklyn, N. Y., was a convalescent hospital for naval personnel and some of the minimal cases were sent there. The U. S. Naval Hospital, Asbury Park, N. J., was also a convalescent hospital.

Those cases receiving a medical survey out of the naval service for reason of tuberculosis were men who were to be treated by their own civilian doctors upon receiving their discharge. Those cases transferred to Veterans' Administration hospitals were men who were still being treated. Upon discharge, they were sent direct to the Veterans' hospitals for continuance of the treatment for tuberculosis.

TABLE 4, PART 1.—*Analysis of the cases sent to U. S. Naval Hospital, St. Albans, N. Y., with their final diagnosis and disposition (tuberculosis)*

Tuberculosis cases diagnosed and sent to U. S. Naval Hospital, Sampson, N. Y.-----	151
Tuberculosis cases sent to Veteran's hospitals-----	3
Tuberculosis cases sent to U. S. Naval Hospital, Seagate, Brooklyn, N. Y.-----	18
Tuberculosis cases sent to U. S. Naval Hospital, Asbury Park, N. J.-----	3
Tuberculosis cases receiving medical survey-----	4
Total cases with confirmed diagnosis of tuberculosis-----	179

The follow-up on the cases other than those cases diagnosed tuberculosis, active, are itemized in table 4, part 2. As shown all these cases were held up temporarily from their discharge for treatment and study and then discharged as soon as they were considered physically fit. The cases include those tentatively diagnosed tuber-

culosis cases which were studied and found not to have active tuberculosis. Some of these cases were returned to the separation center for discharge with the Navy diagnosis of "No Disease," while others were held at the hospital for longer periods of 2 to 3 months, studied thoroughly, and returned for discharge with the diagnosis "Tuberculosis Pulmonary Reinfection, Arrested, Minimal."

TABLE 4, PART 2.—*Analysis of cases with other than a final diagnosis of tuberculosis and their disposition*

Cases returned to Lido Beach, N. Y., for separation from U. S. Naval Hospital, St. Albans, N. Y.-----	65
Cases discharged direct from U. S. Naval Hospital, St. Albans, N. Y.-----	73
Cases sent to dispensary, U. S. Naval Personnel Separation Center, Lido Beach, N. Y. (pneumonitis)-----	54
Cases sent to U. S. Naval Hospital, Brooklyn, N. Y. (neoplasm)-----	3
Cases transferred with no records in hospital files-----	23
Total cases with confirmed diagnosis of tuberculosis-----	179
Grand total-----	397

The remaining cases sent to the hospital for various causes were returned to the separation center or discharged direct from the hospital at the completion of their study and treatment. There were 3 cases of established diagnosis of lung tumor which were sent on to the U. S. Naval Hospital, Brooklyn, N. Y., for further study and treatment. The pneumonia cases sent to the dispensary at the separation center were returned to duty and discharged after having received adequate treatment and when they were considered physically fit.

Table 5 gives the percentages of tuberculosis cases correctly diagnosed by the x-ray department at the separation center. Also given is the percentage of the cases not found to be tuberculosis or which were considered tuberculosis in its arrested phase by the doctors at St. Albans Hospital. The 179 confirmed cases of tuberculosis represented 0.063 percent of the grand total of 283,225 chest films viewed.

TABLE 5.—*Analysis of the percentages of the cases with a proved diagnosis of tuberculosis*

	Number	Percent
Total cases tentatively diagnosed as tuberculosis-----	305	
Total cases with confirmed diagnosis of tuberculosis-----	179	58.7
Number of tentatively diagnosed cases of tuberculosis minus number of confirmed cases of tuberculosis (cases either returned to U. S. Naval Personnel Separation Center, discharged direct from the hospital, or diagnosed tuberculosis, minimal, arrested and discharged)-----	126	41.3

SUMMARY

1. The results of a review of 283,225 chest photofluorograms are presented. These results show the incidence of tuberculosis in the non-

hospitalized young male population of the U. S. Navy. The nontuberculosis cases are also reviewed.

2. Three hundred and ninety-seven men were hospitalized, of these, 305 were for suspected tuberculosis and 92 for the nontuberculosis cases.

3. The follow-up of all the cases hospitalized was carried out by reviewing the findings made at the U. S. Naval Hospital, St. Albans, N. Y. Approximately 48 percent of the men hospitalized were held up only temporarily from their discharge for study and treatment.

4. There were 179, or 0.063 percent, cases of confirmed tuberculosis, out of the grand total of 283,225 chest 35 mm. photofluorograms viewed.

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LONG-TERM OBSERVATION OF PLASMODIUM VIVAX MALARIA IN THE RETURNED SERVICEMAN¹

Part III

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NEUROPSYCHIATRIC PROBLEMS IN PATIENTS WITH RECURRENT VIVAX MALARIA²

This portion of the article will deal with the neuropsychiatric problems occurring in the patients with recurrent chronic vivax malaria as seen by the authors over a period of approximately 3 years. During this period there was presented the opportunity of examining between

¹ This is the last of the three parts in which this article has been published.

² This section was prepared by A. S. Levine.

250 and 300 patients referred by the Tropical Disease Service. In this discussion no effort will be made to present a statistical study of the observations, for the reason that it is believed that statistical studies of psychiatric patients, especially where total personality reactions are to be evaluated, are not of any particular significance. There are too many interdependent, variegated factors at play in the dynamics of personality behavior. It is felt that the interpretation of the material given in any psychiatric study is dependent upon the orientation, training, and ability of the examiner, and the observations will be presented with this in mind.

Before discussing the psychiatric problems in this series, there should be mentioned organic central nervous system involvement in malaria. It is recognized that there is a considerable literature describing central nervous system involvement. The authors can state without any equivocation that at no time, in any of the patients, was there seen any clinical evidence to suggest organic involvement of the central nervous system. There were no deaths due to malaria, and therefore no specimens were available for pathologic study. The reason for this, no doubt, is that there were under observation only cases of recurrent vivax malaria. This concurs with the observation of Fitz Hugh, Jr., et al. (22) that "Cerebral Malaria is chiefly a result of *P. falciparum* infection." These same observers further indicated that the "diagnosis of the cerebral form of malaria in contradistinction to simple severe malaria is occasionally a matter of personal bias of the observer." In discussing the prognosis of cerebral malaria they stated that this disease "either kills or is 'cured' without residual disability."

These observations fit in well with the authors' explanation for the complete lack of clinical evidence of organic involvement of the central nervous system in the large series.

In reviewing the available literature concerning organic involvement of the central nervous system in malaria, there were found reported pathological lesions in the brain of petechiae, malarial nodules, Durk granulomata, capillary occlusions and thromboses, and even, in some instances, more specific nerve tract and system involvement. In all of these, however, the pathogens were *P. falciparum*, or were not given, or the studies were inconclusive and of no value. Rigdon-Fletcher (23) reported the specific lesions of petechiae, malarial nodules, Durk granulomata and other degenerative changes in the myelin as occurring in fatal cases of malaria. The reader is referred to this excellent article for a further review of the literature on this subject. It was suggested in this study that anoxia appeared to be the basis of the development of these lesions. It was not clear from the report, however, what variety of malaria was being considered, al-

though a fatal case described by these authors was infected with *P. falciparum*. One may assume that some cerebral anoxia occurs in the acute febrile stage of vivax malaria, but it is felt that this cerebral anoxia is temporary and reversible. All that can be said is that with clinical examining techniques available to them, the authors have seen no evidence of irreversible organic involvement of the central nervous system.

The syndrome described by S. K. Wilson (24) in which there is discussed a post-malarial asthenia, was infrequently seen by the authors, this being recognized and treated by the malariologists on their own service. Whether the cause is a specific malarial toxin or the debilitating effect of the acute illness, or even a combination of causes, it is felt the problem of post-infectious asthenia can be safely left in the hands of the internists. This is no more a specific neuropsychiatric problem than is the asthenia following other acute infections with which it has much in common. However, when the "post-malarial asthenia" is out of proportion to what one should expect, then, as will be seen later, the total personality reaction has to be evaluated. It is the inappropriate, "out of proportion" reaction of asthenia which persists and becomes worse, even as the disease itself improves, that concerns the psychiatrist. Psychological factors are then found to play a predominant etiological role. Zeligs (20) noted that when the "symptoms of operational fatigue or other concurrent involvement, especially tropical infections such as amoebiasis and hookworm are recognized and specifically treated, these patients recover most gratifyingly despite the systemic persistence of their malaria." The authors agree with this, and can only emphasize that all psychological etiological factors must be investigated in persistent forms of malaria, and that when the total situation of the patient is visualized, the asthenia becomes understandable.

S. P. GOODHART (25) in reviewing the literature for his discussion of malarial amnesia referred to the case described by Forli in which there was vertigo, vomiting, ataxia, asthenia, muscular hypertonus, and nystagmus 15 days following a malarial paroxysm. Forli attributed this syndrome to the "specific toxin" of malaria. No similar picture was noted in any of the patients seen at this activity. In one instance, a vascular cerebral syndrome occurred in an elderly man 1 week following an acute malarial paroxysm, but after careful observation it was concluded that cardiovascular pathology unrelated to the malaria was of etiological significance. This is cited merely to emphasize the great care that is necessary in establishing a causal etiological relationship.

Goodhart further commented that "I believe that when the usual malarial manifestations are represented by a psychic equivalent, we

find a neuropathic soil." This concept is believed to be still pertinent today, and that it was not sufficiently recognized in many of the reported cases of cerebral malaria. In fact, even in the case of malarial amnesia reported by Goodhart at that time, it is felt that although his conclusion as given above is valid, he failed to make appropriate use of his own deductions. Amnesia, as a syndrome, related specifically to a cerebral toxin or infection was never seen in this study; although amnesias of psychogenic etiology did occur with as high a frequency in the malarial group as in the nonmalarial group.

In this discussion only passing mention of the delirium that is seen in the acute phase of the malarial paroxysm will be made. It is recognized that the delirium may precede, accompany, or follow the paroxysm. It is felt that this reaction is in no way different in its pathology than the delirium of other acute infectious disorders. The expression of the delirium, as well as the threshold of appearance, depends largely on the total personality make-up of the individual concerned. This reversible psychotic episode which appears symptomatically in malaria has been described as a phenomenon of the "release of inhibiting or repressing factors" (26).

In this study the chief concern was with those cases of recurrent malaria presenting mental symptoms following repeated attacks. In order to understand better the inferences and conclusions of this discussion, it might be well to outline the psychiatric concepts utilized in the study.

In psychoneurosis, the causative factors are traceable, the authors believe, to recurrences and fantasies of early life with reactions to these incidents in the form of personality traits. It is important to emphasize the last part of this statement, "with reactions to these incidents in the form of personality traits." It is not necessary that there be any direct relationship or tie-up to an early emotional state which remains dormant in the unconscious part of the personality structure until it is activated by some exciting cause. Rather it is believed that these early experiences tend to form personality traits, methods of reaction, and methods of emotional response, which establish patterns of behavior for future experiences and activities. Since the life experiences of any one individual and his reaction to them are not the same as that of any other individual, many different types of personality structures are dealt with in the handling of these patients. Therefore no uniform composite picture of response of a personality to recurrent malarial episodes can be expected. An intensive investigation of early personality development and traits, a critical examination of how that particular personality handled anxiety, his methods of compensation, repression, sublimation, rationalism, etc., is necessary. After this is done the service relationship must

be evaluated. Motivation and morale are extremely important factors and are largely determined by previous personality traits, service experiences, and by nonservice environmental factors. The patient's reaction to somatic illnesses of any kind must be evaluated on the basis of previous experiences, followed by his response to his present illness. In general, it is to be noted that the total personality and not just the specific illness must be considered in the handling of the patients, particularly in those presenting symptoms of psychogenic variety. For the most part, it is impossible to handle these patients successfully unless one has this concept because, all too frequently, presenting symptoms are passed off as being unimportant when no organic cause for them can be found. Sufficient cause for the presenting symptoms is readily noted when one studies the total personality of the individual in his total environment, the latter including, in part, his malaria.

The type of presenting symptoms for which these patients with recurrent malaria were referred to the psychiatrist were as follows: (*a*) Feelings of apprehension and anxiety; (*b*) headache; (*c*) excessive perspiration; (*d*) tremulousness; (*e*) irritability; (*f*) resentment; (*g*) startle reaction; (*h*) nightmares and disturbed sleep; (*i*) gastro-intestinal disturbances, in particular vomiting and diarrhea; (*j*) cardiac palpitation and dyspnea; (*k*) marked feelings of asthenia and disintegratedness; (*l*) intolerance of service-connected activity; and (*m*) just plain "nervousness and restlessness." These symptoms occur in various combinations and alone. Frequently a syndrome suggestive of a fatigue combat state was noted in pure form. It should be noted that most of the patients came from the Pacific war area and were Marines.

In studying these patients in cross section view they were generally noted to be extremely irritable, and to show marked evidences of anxiety. Their motivation was extremely low and marked resentment against any experiences related to the service was readily described. They were completely intolerant of any service activities and in particular of combat situations. They showed marked evidences of tremulousness and restlessness which were aggravated in the interview situation and when under observation. They were, as a rule, extremely suggestible and under direct questioning admitted many somatic complaints which were not mentioned spontaneously previously. Some of the patients had to be probed deeply in order to uncover their anxiety and hostility. They had learned to handle their anxiety by repression. These latter patients frequently appeared to be very schizoid in their reactions until the hostility and anxiety was uncovered by probing or by use of amytal narcosis. Frequently these latter patients came to the attention of the medical officer through the intervention of a third interested party such as

a wife or relative who observed the peculiar behavior of the patient and described marked personality changes. Other patients, overwhelmed by recurrent episodes of mounting anxiety, reacted with symptoms of depression. These patients are usually easily seen as being mentally ill because on the ward they are obviously depressed and are retarded, seclusive, weep a good deal, have many somatic complaints, and are indifferent to liberties and special privileges except when seeking relief in alcoholic indulgence. When intoxicated they are more easily able to express their aggression. If this aggression is directed outwardly they frequently get involved in some difficulty, usually with civilians or superior officers. This expression of hostility seems to afford some relief. If the aggressive feelings are directed inward, however, a vicious cycle is set up which may terminate with a serious suicidal attempt.

Hostility and resentment were present in a large majority of these patients. It was noted that many of them had previously had a strong motivation with high group morale. They had strongly identified themselves with their buddies and with a particular division or regiment. Upon return to this country, after a tour of combat duty, marked resentment against the Marine Corps began to show itself. The morale and the identification noted before became completely lost. Practically all of the Marine patients expressed marked resentment about being assigned duty with "4-F'ers," who had been in this country all the time and who, because of military reasons, were of higher rate than the patient. Deeper probing, however, in these patients revealed feelings of guilt based frequently upon fantasy rather than reality about their own part in a combat situation. This guilt feeling is then strengthened by identification with the "4-F's." This feeling of guilt as a source of anxiety and hostility has been recognized by many in the handling of combat-induced neurotic patterns. However, in some instances no such deep-seated unconscious forces were elicited as the cause for feelings of hostility, resentment, and anxiety, but rather situational factors were observed. Gross mishandling of the patient since his return to this country was noted in many instances. Verified instances were noted, in which the patient "was taken advantage of" by personnel who had never been overseas and who were possibly solving their own emotional conflict because of this by their high-handed methods of handling personnel under them. Fortunately, the latter cases were not very frequent.

Many examples have been seen in the investigation of what appeared to be the manifestations of pure anxiety in an individual to be completely replaced by hostility by some mechanism, as previously suggested. It would seem that this mechanism is an attempt on the part of the personality to resolve his anxiety. However, the hostility,

being unacceptable to the personality in its adjustment to the environment, in turn generates more anxiety. Thus, a vicious cycle is established. Very frequently the patient is totally unaware of his anxiety and his hostility. He recognizes only a strong tendency to "blow my top." These patients, because of this strong underlying vicious cycle, are domineering in their relationships with people and with every situation with which they come in contact. They are unable to take orders in the service and are intolerant of people who try to do so and of those who attempt to teach them new methods of work, or to change their established patterns of behavior which are incompatible with existing conditions. They express overtly and with marked verbosity their hostility and resentment against the armed forces. It is in the expression of this hostility and resentment that their anxiety becomes very marked. The cycle referred to may then become so overpowering as to cause the patient to "break down" completely and transient psychotic episodes are noted.

At this point there might be mentioned briefly the many difficulties in which these patients become involved. Repeated infractions of regulations, difficulty with civilian authorities, divorces, fights, etc., seem to become a pattern of behavior in some of them. Very frequently this is seen as a complete personality change. Following the trend of thought developed above, these reactions are readily seen as evidence of illness. With proper treatment, this type of behavior ceases and healthier outlets are found.

Other situational factors were also often uncovered. Thus, the patients frequently described that after having returned to this country perfectly well except for recurrent attacks of malaria, some event occurred which made more propitious their separation from the service. Often a relationship between marriage and the onset of symptoms was noted, also failure to obtain a promotion, being on the list for transfer overseas, transfer to an uncertain and insecure duty station, severe punishment for mild infractions of regulations, the experience of having buddies and friends secure their separation from the service, etc. Such precipitating events were noted frequently and were related to the patients' motivation, to his previous personality structure, etc. Frequently, a very mild combat-induced anxiety state, which ordinarily would have cleared in a period of a year or 18 months becomes aggravated and fixed by a situation such as described. In these cases the psychoneurotic syndrome loses its combat-induced nature and is perpetuated by secondary factors which are situational and are related again to total personality structure as indicated before.

These observations were made following the study of the group of patients with recurrent vivax malaria accompanied by psychogenic disturbances. It should be noted, however, that none of the causative factors as given have been the malarial parasite itself! This is to be

emphasized. The same pictures have been seen repeatedly in non-malarial patients. In fact, an approximate evaluation disclosed that whereas the foregoing types of psychogenic disturbances were seen in about 12 to 15 percent of the malarial patients, they were seen in approximately 15 to 20 percent of a group of service personnel returned from combatant areas for other reasons. In view of the large percentage of service personnel in military hospitals because of psychiatric disabilities, percentages which are at least double the one given for the malarial patients, the role of the malarial parasite becomes insignificant.

The authors are aware of the amount of literature which has developed, attempting to link malaria to various psychogenic disorders. Anderson (7) reported extensively on this subject and was especially interested in proving the lack of responsibility of patients who committed acts against society because of malarial reactions. Although, as will be pointed out later, latent personality weakness might conceivably be made more overt by the general debilitating effect of illness, at no time have the authors seen malaria itself produce any specific disturbance. It is felt that the mere finding of parasites in the blood is not sufficient to establish causal relationship. Asymptomatic parasitemia is a very common finding according to the internist collaborators. Furthermore, the relief of psychogenic symptoms by the use of specific antimalarials does not prove anything more than does the fact that placebos frequently give similar relief. More exhaustive and deeper probing into the personality reactions invariably reveals the true etiologic source.

Anderson's exhaustive exploration of the subject of the malarial psychoses and neuroses will not be discussed further, except to caution against too much enthusiasm about his conclusions of the causal relationship between malaria and psychogenic disorders. Already there has been observed one instance in which the explanation on a psychogenic basis of a murder committed by a serviceman was attempted merely because of the incidental presence of malaria.

A fairly constant observation in the group of patients under discussion, has been the presence of latent anxiety about the infection and the cause of the malaria itself. The amount of anxiety uncovered varied greatly. Invariably there was present a strong tendency to minimize any concern about the malaria. This reluctance to make overt any anxiety concerning the illness was shown by the blocking and evasiveness in any discussion of the subject. Frequently the patient would refer to the operations of previous medical officers, quoting them as saying that over a period of several years the attacks would become less and less severe, and then finally disappear. Further questioning would then reveal that this belief was only superficially subscribed to by the patient, who had deep-seated concern and appre-

hension about his future. It should be remembered, however, that the observation noted is not peculiar to malaria, but is commonly seen in many of the chronic diseases such as tuberculosis, filariasis, chronic neurologic disorders, etc.

Thus far nothing has been said concerning the effects of the debilitating illness of recurrent malaria itself. A reciprocal relation of fatigue and anxiety has been described (27). It is known that a debilitating illness will tend to lower the integrative powers of a personality. With this lowered integration many repressed neurotic symptoms may become overt. The repressions that formerly acted to produce an apparently healthy personality which aided in the adjustment of the total personality in its total environment, as well as other healthy useful mental mechanisms, would break down under the strain of the repeated lowering of the integrative cohesive powers of the personality structure. This might very well explain many evidences of psychopathic behavior observed in patients with recurrent malaria. Thus, there were frequently seen patients guilty of repeated infractions of regulations in whom a careful investigation revealed that their early history had shown evidences of psychopathic personality traits. These had been kept sufficiently latent so that these patients were able to get along with only occasional minor difficulties. With the lowering of the integrative power of personality the latent psychopathy became more overt. In a similar manner many neurotic personality traits also became overt. The production of a psychosis, however, following recurrent malaria was extremely uncommon, probably because there were sufficient precipitating experiences in the military setup prior to the onset of malaria to cause an earlier acute psychotic break. The reactions that have been seen with recurrent malaria occurred chiefly in those whose integrative powers had remained intact during the course of the average or slightly above average strain of military life.

The possibility of lowered cerebral integration as a result of many minute punctate areas of cerebral vascular damage must not be overlooked. If the latter do occur they are sufficiently minute so that they are not discernible by the clinical means of examinations available. However, it is the author's belief that these pathological lesions do not occur, and complete psychological studies, including Rorschach examinations and electroencephalographic studies, tend to collaborate this thesis.

In the rush and pressure of military practice it is very easy to fall into certain platitudes of thought which tend to create false feelings of security in thinking about patients. The mere discovery of psychogenic symptoms in the remote or recent past lead many men to the conclusion that the presenting symptoms for which no organic cause is readily apparent must be caused by similar psychogenic factors.

This is a fallacious method of reasoning into which medical officers frequently fall because of the ease of explaining the symptoms by means of words and thus precluding the need for further investigation. Neurotic traits as a mechanism and a cause by which symptoms are prolonged or continued may be suspected when the patient's attitudes and reactions do not correspond to evidences of improvement in his physical disease. Thus, the persistence of symptoms present in the acute malarial attacks at the time when no organisms are found in the blood stream should naturally arouse the clinician's suspicions. In fact, patients have been seen who, for all purposes, appeared to have a malarial chill, with aches and pain, and yet had no elevation in temperature and showed no evidence of malarial parasites in the blood stream. These would invariably occur when a new draft of men was to be shipped overseas or when hospitalization served some other similar method of escape from an uncomfortable situation. In these very apparent cases as well as the more subtle and less apparent situations, it is extremely important to go beyond the superficial inquiries into the possibility of the presence of any deep-seated difficulty. Very frequently patients had to be seen repeatedly before the pertinent emotional problems were uncovered. Sodium amytal narcosis was especially helpful in this deeper probing as an uncovering technique.

Special comment should be made concerning the symptoms of headache referred to previously. Much has been written recently concerning this symptom and a great deal of overemphasis applied. Zeligs (20) wrote "that between 15 and 20 percent of military personnel with a history of chronic malaria are subject to periodic bouts of mild to severe headache, that headache was one of certain distressing symptoms which occur so often in persons with chronic malaria that one must indict the malarial parasite itself in some way as being specifically responsible * * *". He described the "special features" of this headache and postulated a form of therapy with nicotinic acid. The authors' experience has been at complete variance with that just reported. Zeligs reported that in a group of 25 patients, 40 percent were completely relieved of these headaches, 28 percent had moderate improvement, and 32 percent showed no change. The follow-up data were not given and no mention was made of any psychiatric investigation. In the investigations made in this study headache was found to be no greater a problem in the group of recurrent malarial patients than in the general hospital population. No special characteristics could be found in the headaches of the malarial patients even though they were searched for and the criteria of Zeligs applied. As part of a routine, the patients were given nicotinic acid in varying dosages, depending upon individual tolerance, and in no case was any improvement noted. The empirical use of ergotamine, dilantin, and his-

taminase also applied routinely was unproductive of satisfactory relief of the symptoms. Furthermore, in each case, significant psychogenic etiologic factors were uncovered. The handling and the resolution of the psychogenic problem invariably produced amelioration of the symptoms of headaches.

Kaplan (20) described a case in which he felt a persistent headache was caused specifically by chronic malaria. However, the long-standing history of mental illness in his patient obscures greatly the conclusions reached. It is true that malaria must be included in the differential diagnosis, but a more clear-cut role of its action in producing headache must be given before it can be called the offender.

In concluding this part of the symposium, a word should be said about therapy. The general goal was an attempt to evaluate the patient and his symptoms. The members of the Tropical Disease Service were well aware of the personality problems of their patients and handled many problems on their own wards as these problems arose. This was largely responsible for reducing the psychiatric casualties on the malarial service. As the psychiatric problem assumed a larger role in the patients' illness, consultant help was sought with the treatment still being maintained on the Medical Service. When the psychiatric illness became dominant, the patient was then transferred to the Neuropsychiatric Service.

The therapies carried out by the Psychiatric Service were the usual therapies with nothing special being applied to the patients with chronic malaria. Narcosynthesis, drug therapy, reassurance, suggestion, modified analytic procedures, and rehabilitation measures were all employed. Of special interest was the successful use of subclinical shock insulin therapy in the treatment of acute anxiety states. This will be described more fully in another communication. Hostility toward the service and lack of motivation for the further performance of duty were considered as symptoms of the illness and were treated as such. In general, the results of the therapeutic efforts were gratifying and essentially were no different than the results obtained in nonmalarial group of psychiatric patients.

Conclusion.—Chronic recurrent vivax malaria proved no special psychiatric problem other than being another experience in the life history of the individual. Here it acted like any chronic illness. Psychogenic illness was seen to be no different in nature and in frequency in the group of malarial patients than in the nonmalarial group. In each case of mental illness, total personality studies are indicated and malaria must be considered as merely another incident in the total environment of that personality.

SUMMARY AND CONCLUSION

Clinical observations of 1,500 attacks of *P. vivax* malaria are reported. The diagnosis in the chronic relapses is usually easy to make, but the diagnosis of the primary attack is often difficult and easily missed unless frequent smears are examined by competent technicians. Delayed primary attacks have been observed as long as 18 months following the last suppressive quinacrine dihydrochloride (atabrine). An aid to diagnosis may be the presence of a leukopenia with increase in mononuclear cells, an elevated erythrocyte sedimentation rate, or an otherwise unexplained positive Kahn test. Considering all factors, a "false" serological test for syphilis should not cause confusion. A palpable spleen during the acute attack is commonly found, but the text-book picture of an enlarged spleen of chronic malaria has not been observed in the series. Herpes labialis has been observed in about 20 percent of the acute relapses. Enlargement of the liver has been rare. Serious toxic reactions to quinacrine have not been observed and long-continued treatments of various kinds do not appear to possess any advantage over the routine quinacrine treatment of the acute attack with the possible exception of the plasmochin-quinine treatment which appears to offer the best hope of a "cure" at the present time. There does not appear to be any marked advantage in long-continued suppressive quinacrine medication after leaving the highly endemic malaria areas. With the passage of time away from highly endemic malaria areas, the frequency and severity of relapses shows an unmistakable trend toward the eradication of the malaria within 3 years by development of immunity in the host. Careful neuropsychiatric and other studies including electroencephalogram study of large groups of patients are presented in support of the premise that many of the alleged postmalarial sequelae bear no relation to malaria per se, but are rather directly related to the personality of the individual. No case of *P. falciparum* malaria was observed in this group and no death attributable to malaria occurred.

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Miller, William W., Jr., Lieutenant (MC) USN (*A Simple Method of Converting the Standard Stern-McCarthy Prostatic Electrotome to a Pistol-Grip-Trigger Model*, p. 717). A. B., 1939, and M. A., 1941, University of Wisconsin; M. D., University of Wisconsin Medical School, 1943. Instructor, University of Wisconsin, 1940-41. Appointed ensign, H-V(P) USNR, 7 July 1942; appointed acting assistant surgeon, USN, 29 Mar. 1943 from Wisconsin. Specialty: Urology. Intern, U. S. Naval Hospital, Seattle, Wash., 1943-44; resident in urology, U. S. Naval Hospital, Great Lakes, Ill., 1945-47. Junior fellow: American College of Surgeons; member: American Medical Association.

Moore, Roland C., Lieutenant Commander, H(S) USNR (*Psychiatric Screening Tests at a Precommissioning Center*, p. 676). B. A., Harvard College, 1931; M. A. in psychology, 1933. Psychologist, Worcester State Hospital, Worcester, Mass., and Boston Psychopathic Hospital, Boston, Mass. Appointed lieutenant, junior grade, H-V (S) USNR, 15 May 1942 from Massachusetts. Specialty: Clinical psychology. Served at U. S. Naval Training Center, Newport, R. I., U. S. Naval Training Center, Sampson, N. Y., and U. S. Naval Training Center, Camp Peary, Magruder, Va. Released from active duty 22 Aug. 1946. Now associate in Bureau of Measurement and Guidance, Carnegie Institute of Technology. Member: American Psychological Association and Pennsylvania Psychological Association.

Mosher, William E., Jr., Lieutenant Commander (MC) USNR (Inactive) (*Japanese "B" Encephalitis*, p. 586). A. B., Hamilton College, 1931; M. D., Syracuse University College of Medicine, 1936; M. P. H., Harvard School of Public Health, 1939. Intern, Harper Hospital, Detroit, Mich., 1936-37; assistant district health officer, New York State Department of Health, Albany, N. Y., 1939-41; commissioner of health, Cortland County Health Department, Cortland, N. Y., 1941-. Appointed passed assistant surgeon, USNR, 20 Oct. 1943 from New York. Specialty: Epidemiology and public health.

Served with Epidemiology Unit No. 42, Davisville, R. I.; Military Government Detachment, B-6, Okinawa; Military Government Research Center, E-1, Okinawa. Released from active duty 25 Apr. 1946. Fellow: American Public Health Association; member: Cortland County Medical Society.

Moss, John E., Lieutenant Commander (MC) USN (*A Medical Survey of Allied Repatriates After Liberation From Japanese Prisons*, p. 598). A. B., Duke University, 1936; M. D., Duke University School of Medicine, 1940. Intern in medicine, Johns Hopkins Hospital, Baltimore, Md., 1940-41; assistant resident in medicine, Duke Hospital, Durham, N. C., 1941-42. Appointed assistant surgeon, USNR, 18 Mar. 1942 from North Carolina; transferred to Regular Navy 6 May 1942. Specialty: Internal Medicine. Served on U. S. S. *Thomas Stone*; at U. S. Naval Hospital, Memphis, Tenn., and at U. S. Naval Dispensary, Navy Dept., Washington, D. C. Resigned 31 Jan. 1947. Member: American Heart Association; associate member: American College of Physicians.

Olenick, Everett J., Commander (MC) USN (*Urologic and Ophthalmologic Observations in Two Cases of Reiter's Syndrome*, p. 657). B. S., 1934, and M. S. (in pathology), 1936, University of Illinois; M. D., University of Illinois College of Medicine, 1937; M. S. P. H., University of Michigan, 1939. Intern, Michael Reese Hospital, Chicago, Ill., 1937-39. Appointed assistant surgeon, USN, from Illinois. Specialty: Ophthalmology. Served on U. S. S. *New Orleans* and at Base Hospital No. 8, Pearl Harbor, T. H., and U. S. Naval Hospital, Great Lakes, Ill. Fellow: American Medical Association.

Pinto, Joseph C., Lieutenant Commander (MC) USN (*The Eye Method of Resuscitation*, p. 650). B. S., St. Joseph's College (Philadelphia), 1937; M. D., Hahnemann Medical College and Hospital of Philadelphia, 1941. Intern, West Jersey Homeopathic Hospital, Camden, N. J., 1941-42. Appointed assistant surgeon, USNR, 12 Aug. 1941; transferred to Regular Navy 11 Oct. 1943. Served on U. S. S. *Bainbridge*.

Robbins, Frederick R., Captain (MC) USNR (Inactive) (*Appendicitis in a United States Naval Hospital*, p. 634). B. S., University of North Carolina, 1919; M. D., University of Pennsylvania School of Medicine, 1921. Intern, 1921-23, and chief resident physician, 1923-26, Pennsylvania Hospital, Philadelphia, Pa.; assistant surgeon, 1926-30, associate surgeon, 1930-46, and consulting surgeon, 1946, Children's Hospital, Philadelphia, Pa.; assistant surgeon, 1927-46, and surgeon, 1946, Pennsylvania Hospital, Philadelphia, Pa.; assistant surgeon, Bryn Mawr Hospital, Bryn Mawr, Pa., 1926-47; associate in surgery, University of Pennsylvania School of Medicine, 1946, and assistant professor in surgery, 1947, Graduate School of Medicine, University of Pennsylvania, 1946; consulting surgeon, Valley Forge General Hospital, 1947. Appointed surgeon, USNR, 29 May 1935 from Pennsylvania. Specialty: Surgery. Served as chief of surgery, U. S. Naval Mobile Hospital No. 3 and at U. S. Naval Hospital, U. S. Naval Operating Base, Norfolk, Va. Released from active duty 21 November 1945. Fellow: American College of Surgeons, Philadelphia College of Physicians, and Philadelphia Academy of Surgery; member: American Medical Association, Medical Society of the State of Pennsylvania, Philadelphia County Medical Society, and Maine Line Branch of Montgomery County Medical Society. Diplomate: American Board of Surgery.

Sargent, James W., Lieutenant (MC) USN (*Urologic and Ophthalmologic Observations in Two Cases of Reiter's Syndrome*, p. 657). B. A., University of

Michigan, 1939; M. D., University of Michigan Medical School, 1943. Appointed ensign, H-V(P) USNR, 28 Mar. 1942 from Wisconsin; appointed acting assistant surgeon, USN, 13 Feb. 1943. Specialty: Urology. Intern, U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., 25 Feb. 1943-6 Jan. 1944. Served 2 yrs. with Fleet Marine Force and 1 yr. at U. S. Naval Hospital, Great Lakes, Ill. Resigned 15 Jan. 1947. Now fellow in urology, Mayo Foundation, Mayo Clinic, Rochester, Minn. Member: American Medical Association, State Medical Society of Wisconsin, Milwaukee County Medical Society.

Saunders, George M., Lieutenant Commander (MC) USNR (Inactive) (*Long-Term Observation of Plasmodium Vivax Malaria in Returned Serviceman*, p. 753). A. B., University of Wisconsin, 1923; M. D., Harvard Medical School, 1925. Intern, Harper Hospital, Detroit, Mich., 1925-26, and Massachusetts General Hospital, Boston, 1926-28; tropical and preventive medicine, working with the Rockefeller Foundation and the Leonard Wood Memorial, Africa, West Indies, and Far East, 1930-40; helped to organize the medical service for the air route across Africa, Pan American Airways, 1941; assisted in organizing and developing the Division of Health and Sanitation of the Office of the Coordinator of Inter-American Affairs, 1942, and was director of the Division's work in Brazil, regional director after November 1942 for Brazil, Paraguay, Peru, Bolivia, and Chile. Appointed surgeon, USNR, 3 May 1944. Served at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Released from active duty 25 Feb. 1946. Assistant professor of preventive medicine, Washington University School of Medicine, May 1946-; consultant in tropical diseases, ward medical services, Barnes Hospital, St. Louis, Mo., Dec. 1946-. Diplomate: National Board of Medical Examiners.

Sideman, Sidney, Commander (MC) USNR (*Osteoplastic Repair of Defects of the Tibia Following Osteomyelitis Due to Trauma*, p. 683). B. S., University of Illinois, 1925; M. D., University of Illinois College of Medicine, 1928. Intern, Michael Reese Hospital, Chicago, Ill., 1927, and Cook County Hospital, Chicago, 1928-29; attending orthopedist, Michael Reese Hospital and associate orthopedist, Cook County Hospital; associate orthopedic faculty, Northwestern University Medical School. Appointed surgeon, USNR, 30 June 1942. Specialty: Orthopedic surgery. Served with U. S. Naval Fleet Hospital No. 110, and at U. S. Naval Training Station, Great Lakes, Ill., and U. S. Naval Hospital, San Diego, Calif. Released from active duty 5 Feb. 1946. Fellow: American Academy of Orthopedic Surgeons; member: American Medical Association, Clinical Orthopedic Society, Illinois State Medical Society, and Chicago Medical Society. Diplomate: American Board of Orthopedic Surgery.

Smith, Jarvis M., Commander (MC) USNR (*Report on Primary Bone Grafts*, p. 579). B. S., Pennsylvania State College, 1928; M. D., Columbia University College of Physicians and Surgeons, 1932. Intern, Newark City Hospital, Newark, N. J., 1932-34; resident in orthopedics, 1941-42, and assistant surgeon, 1946-, New Jersey Orthopedic Hospital and Dispensary, Orange, N. J.; visiting surgeon, Morristown Memorial Hospital, Morristown, N. J., 1946-. Appointed passed assistant surgeon, USNR, 8 Apr. 1942 from New Jersey. Specialty: Orthopedic Surgery. Served at U. S. Naval Hospital, St. Albans, N. Y., and at dispensary, U. S. Naval Air Station, Norfolk, Va. Released from active duty 1 Apr. 1946. Member: American Medical Association, Medical Society of New Jersey, and Essex County Medical Society.

- Stott, Ardenne A.**, Captain (MC) USNR (*Chorionepithelioma*, p. 702). M. D., Tufts College Medical School, 1907. Intern, National Soldiers' Home, 1907-08; private practice, 39 years; visiting surgeon, Bath Memorial Hospital, Bath, Maine, 1908—. Appointed assistant surgeon, USNRF, 8 Jan. 1918 from Maine; transferred to Regular Navy 1 Mar. 1918; resigned 8 Sept. 1919; appointed past assistant surgeon, USNR, 29 June 1925. Served at U. S. Naval Hospital, Portsmouth, N. H., and U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Fellow: American College of Surgeons; member: American Medical Association and Maine Medical Association.
- Taylor, Ralph W.**, Captain (DC) USN (*Dentigerous Cyst*, p. 696). D. D. S., College of Dentistry, University of Southern California, 1924. Clinical instructor, University of Southern California, Sept. 1926-July 1928. Appointed lieutenant, junior grade, USN, 2 July 1928, from California. Specialty: Oral surgery. Served at U. S. Naval Dental School, National Naval Medical Center, Bethesda, Md., and U. S. Naval Hospital, Pearl Harbor, T. H. Fellow: American College of Dentists; member: American Dental Association, American Society of Oral Surgeons, and International Association for Dental Research.
- Thomas, Marcel P.**, Lieutenant Commander (MC) USNR (Inactive) (*The Relationship Between Measles and Tuberculosis*, p. 617). B. S. in education, Ball State Teachers College, 1929; M. D., Hahnemann Medical College and Hospital of Philadelphia, 1935. Intern, Huron Road Hospital, East Cleveland, O., 1935-36; private practice, Cleveland, O., 1936-40; graduate assistant, internal medicine, Massachusetts General Hospital, Boston, Mass., 1940-41; senior visiting staff, Huron Road Hospital, East Cleveland, O., 1941. Appointed passed assistant surgeon, USNR, 9 Sept. 1942. Specialty: Internal medicine. Served at U. S. Naval Advance Base, Finchhafen (Finchhaven), New Guinea; and U. S. Naval Hospital, San Diego, Calif. Released from active duty 28 Oct. 1946. Postgraduate study, Harvard Medical School, 1946-.
- Tilney, Robert W., Jr.**, Lieutenant (MC) USNR (Inactive) (*A Review of 283,225 Chest Photofluorograms at the U. S. Naval Personnel Separation Center, Lido Beach, Long Island, N. Y.*, p. 749). A. B., Harvard College, 1939; M. D., University of Pennsylvania School of Medicine, 1943. Intern, Peter Bent Brigham Hospital, Boston Mass., 15 Jan. 1943-1 Jan. 1944. Appointed ensign, D-V(G) USNR in 1939; ensign H-V(P) USNR 28 Nov. 1942; and assistant surgeon 29 Apr. 1943. Served on U. S. S. *Baxter* and at U. S. Naval Separation Center, Lido Beach, N. Y. Released from active duty 11 Aug. 1946. Fellow in pathology, Strong Memorial Hospital, Rochester, N. Y., Sept. 1946-May 1947; assistant resident in surgery, Roosevelt Hospital, New York, N. Y., July 1947-.
- Weeks, Kenneth D.**, Lieutenant (MC) USNR (Inactive) (*Hemorrhagic Smallpox: Report of a Case With Recovery*, p. 707). B. S., Davidson College, 1935; M. D., Duke University School of Medicine, 1939. Intern, Duke Hospital, Durham, N. C., July 1939-June 1941; assistant resident in pathology, Vanderbilt University Hospital, Nashville, Tenn., 1941-42; assistant resident, 1942-43, resident physician, 1943-44, and instructor in medicine, Mar. 1947-, Duke Hospital, Durham, N. C. Appointed assistant surgeon, USNR, 1 Sept. 1943. Served at U. S. Naval Hospital, Charleston, S. C.; U. S. Naval Dispensary, Saipan, M. I.; and on U. S. S. LST (H) 950, Okinawa Campaign. Released from active duty 12 June 1946. Diplomate: National Board of Medical Examiners.

Will, Otto Allen, Jr., Lieutenant Commander (MC) USN, Retired (*A Consideration of the Significance of Hallucinations*, p. 622). A. B., Stanford University, 1933; M. D., Stanford University School of Medicine, 1940. Intern in internal medicine and psychiatry, 1939-40, assistant resident in pediatrics, 1940-41, and assistant resident in internal medicine, 1941-42, Stanford Lane Hospital, San Francisco, Calif. Appointed assistant surgeon, USN, 26 Mar. 1942, from California. Specialty: Psychiatry. Psychiatric staff, St. Elizabeths Hospital, Washington, D. C., 1943-47. Retired 1 June 1947. Member: American Society for Research in Psychosomatic Problems. Diplomate: American Board of Medical Examiners.



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BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112



COVER PHOTOGRAPHS

In this number of the BULLETIN is an article on Passed Assistant Surgeon Elisha Kent Kane, U. S. Navy, who was the first American Arctic explorer to achieve international fame. The lower picture shows his ship, the *Advance*, during his second expedition in 1853-55. In contrast, the upper picture shows Polar exploration from the air during the recent U. S. Navy expedition to the Antarctic. The lower picture is reproduced from Kane's narrative and the upper is a U. S. Navy official photograph.

TABLE OF CONTENTS



	Page
PREFACE	III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Care of Dependents in the Navy — <i>Morton D. Willcutts</i>	777
Vagotomy in the Treatment of Peptic Ulcers — <i>Edward S. Lowe</i>	785
Penicillin in the Treatment of Gonococcus Infection Urethra; Report of Three Hundred Cases — <i>Arthur L. Lawler</i>	796
Local Penicillin Therapy for Tropical Ulcer — <i>Charley F. Gutch</i>	801
Rheumatic Fever in the Negro — <i>John M. Vesey</i>	805
Benadryl as a Therapeutic Agent in the Treatment of the Common Cold — <i>John M. Brewster</i>	810
Clinical Report of the Use of Benadryl in 100 Cases — <i>Edwin E. Barksdale and William K. Hall</i>	812
Acrylic Resin Denture Material — <i>Henry A. Collett, Jr.</i>	817
Incidence of Palpable Lymph Nodes — <i>Warren W. Moorman</i>	821
Intradermal Tests With <i>Dirofilaria Immitis</i> Extract in Human Filariasis — <i>Mendel Zeligs</i>	824
A Statistical Review of 1,000 Orthopedic Consultations at a Naval Dispensary — <i>Robert F. Legge</i>	827
Psychiatric Data Compiled at a United States Naval Personnel Separation Center — <i>Robert S. Schwab</i>	830
Laboratory Examinations for Tuberculosis — <i>Wylma F. Funk</i>	835
The Diagnosis of Combat Fatigue — <i>Philip Solomon</i>	850
Tests on the Prevention of Fracture of Glass Containers Due to Freezing of Their Liquid Contents — <i>Carl A. Schlack and S. Robert Howell</i>	857
The Story of Elisha Kent Kane, Surgeon, U. S. Navy — <i>Moses C. Shelesnyak</i>	861

EDITORIALS

Book Review Number of the UNITED STATES NAVAL MEDICAL BULLETIN	872
A New Approach to the Venereal Disease Problem	873
Fallacies and Facts in Regard to Swimming	874
The Frequency of Syphilis and Gonorrhea as Concurrent Diseases	875
Alcoholism	875

CLINICAL NOTES

	Page
Acute Hemolytic Anemia Following the Intraperitoneal Administration of Sulfanilamide; Report of a Case—Howard A. Johnson	877
Reconstruction of the Thumb—Otto W. Wickstrom and John B. Patterson ..	880
Intestinal Perforation Resulting From Atmospheric Blast—Harold Fink ...	884
Infectious Mononucleosis; Report of Case in a Negro—Daniel N. Stewart, Jr.	889

MEDICAL AND SURGICAL DEVICES

Improved Guillotine Operation and Retractor—Charles Mrazek	892
---	-----

BOOK NOTICES

Musical Sons of Aesculapius, Marmelszadt—Textbook of Medicine, edited by Conybeare—Office Endocrinology, Greenblatt—Human Biochemistry, Kleiner—The Diagnosis and Treatment of Bronchial Asthma, Gay—Surgical Treatment of Soft Tissues, edited by Bancroft and Humphreys—The Treatment of Diabetes Mellitus, Joslin, Root, White, Marble, and Bailey—Penicillin in Neurology, Walker and Johnson—Manual for Dental Technicians, Salzmann—Intracranial Complications of Ear, Nose and Throat Infections, Brunner—Diseases of Metabolism, edited by Duncan; with contributions by 21 authors—Principles and Practice of Obstetrics, DeLee and Greenhill—Military Neuropsychiatry, edited by Ebaugh, Solomon, and Bamford, Jr.—Buchanan's Manual of Anatomy, edited by Jones; with the assistance of Patterson, Barlow, Mottershead, Wilde, and Dobson—Penicillin: Its Application, under general editorship of Fleming—The Principles and Practice of Medicine, Osler, Christian—Radiology for Medical Students, Hodges, Lampe, and Holt—Topley and Wilson's Principles of Bacteriology and Immunity, revised by Wilson and Miles—Physician's Handbook, Warkentin and Lange—Modern Dermatology and Syphilology, Becker and Obermayer—Penicillin in Syphilis, Moore—Mental Mischief and Emotional Conflicts, Sadler—Diseases of the Heart, Lewis—Bone and Bones, Weinmann and Sicher—Peripheral Vascular Diseases, Allen, Barker, and Hines, Jr.—Outline of the Spinal Nerves, Favill—Clinical Pediatrics, Kugelmass—Synopsis of Obstetrics and Gynecology, Bourne—The Diagnosis and Treatment of Pulmonary Tuberculosis, Stone and Dufault—Women in Industry: Their Health and Efficiency, Baetjer—An Introduction to Human Anatomy, Marshall; revised by Lazier—Synopsis of Physiology, Main—P—Q—R—S—T, Rise-man—The 1946 Year Book of Neurology, Psychiatry, and Neurosurgery, Reese, Masten, Lewis, and Bailey—Muscle Testing; Techniques of Manual Examination, Daniels, Williams, and Worthingham—Bacteriology, compiled by Novak and Meyer—The Art and Science of Nutrition, Hawley and Carden—Nutritional and Vitamin Therapy in General Practice, Gordon—Peripheral Vascular Diseases, Samuels	895
--	-----

TABLE OF CONTENTS

VII

PREVENTIVE MEDICINE

	Page
Poliomyelitis: Study of an Epidemic of Forty Cases, Key West, Fla. (May–August 1946); Part I—<i>William D. Davis and Charles M. Silverstein</i>	910
A Schick Survey on Guam—<i>Harold Jacobziner</i>	923
The Incidence of Intestinal Parasites Among Civilians Employed at Certain Naval Air Bases—<i>Donald MacCreary and Arnold G. Bricker</i>	926
NOTES ON CONTRIBUTORS	930



ADDRESS YOUR REPLY TO
BUREAU OF MEDICINE AND SURGERY
NAVY DEPARTMENT, WASHINGTON 25, D. C.
AND REFER TO NO.



WASHINGTON 25, D. C.



Fellow Officers of the Medical Department:

Legislation of momentous importance to the Medical Department of the Navy was enacted during the first session of the Eightieth Congress. The progress of this legislation has been closely followed in the press and official instructions concerning these bills will appear in the near future. It is believed that the highlights of these changes are of great interest, particularly to Medical Department personnel at sea and at overseas stations where such information is not always as readily available as in the continental United States.

(1) For the purpose of reimbursing medical and dental officers for the excess time and funds required in their preparation for a service career and because of the shortage of these officers in the Regular Navy, a bill was passed to provide for additional inducements for doctors of medicine and dentistry to make a career of U. S. Military, Naval, and Public Health Services.

(a) Title I of this bill provides for additional pay for medical and dental officers over and above all other pay and allowances of \$100 per month. This will apply to all Regular medical and dental officers and to all Reserve officers who may volunteer for extended active duty of one year or longer. There is an eligibility period of five years after the date of enactment during which officers may become eligible for this increase in pay to allow for a trial period to determine the success of the bill. However, when once eligible, the additional pay will continue for a full service career of thirty years, until a total of \$36,000 has been received. The Bureau has earnestly advocated this legislation, particularly as an added inducement for young medical and dental officers to join the Regular Navy and give serious consideration to a lifetime career in the service. V-12 medical and dental officers serving involuntarily will be acceptable for commissions in the Regular Navy and upon becoming medical officers or dental officers of the Regular Navy will obtain this added compensation.

(b) Title II of this bill permits the commissioning of doctors and dentists either from the Reserve ranks or from civilian life in higher age groups and in higher ranks up to and including captain in the Medical or Dental Corps as extra numbers. This will furnish an additional avenue of procurement to fulfill our needs.

(2) The bill for promotion and elimination of officers provides that the number of rear admirals in each Staff Corps shall be five-tenths of one percent of the officers on the active list in that Corps at any one time. The number, however, in the Medical Corps shall not exceed fifteen. The promotion and selection details for the Dental Corps are uniform with those of the Medical Corps. The number of rear admirals in the Dental Corps is limited to four. All promotions above the rank of lieutenant junior grade will be by selection. The details of the selection provisions are too extensive to be given here. However, another feature of the bill especially worthy of notation because of its particular interest to the Medical Corps, is a provision for the integration of members of Staff Corps with Line running mates. In accordance with the new arrangement,

members of a given group of medical officers will become eligible for promotion on a graduated scale extending from the top to the bottom of their corresponding Line group, instead of the whole group having to wait for the anchor man of the Line class to make his number before any member of the medical group would become eligible. There are provisions for retirement if twice passed over for selection, and after a certain number of years of service, which differ for the various grades.

(3) The Nurse Corps has been established as a part of the Medical Department and as one of the Staff Corps of the Navy with commissioned rank from ensign to commander, the Director to be a captain selected from officers of lieutenant commander or above. The authorized strength of the Corps is six nurses for each 1,000 total personnel.

(4) A bill has been passed entitled "The Army-Navy Medical Services Corps Act of 1947": Title I of this bill pertains to the Army entirely.

(a) Title II provides for the establishment in the Medical Department of the United States Navy a Medical Services Corps which shall consist of a Pharmacy, Supply, and Administrative Section, a Medical Allied Scientists Section, and an Optometry Section, and such other sections as may be deemed necessary by the Secretary of the Navy. Members of this Corps shall hold commissioned ranks ranging from ensign to captain. The authorized strength of this new Corps has been established as 20 percent of the authorized strength of the Medical Corps. All initial appointments herein will be made from temporary U. S. Navy officers and Reserve officers under the provisions of the so-called Transfer Law, Public Law 347.

(b) Title II.--All subsequent appointments will be made from warrant and commissioned warrant officers of the Regular Navy and from among graduates of accredited schools granting degrees in sciences allied to medicine: pharmacy and optometry. These subsequent appointments will be made in the grade of ensign, except that those holding doctorate degrees in sciences allied to medicine may be appointed as members of the Medical Allied Science Section with the rank of lieutenant junior grade. This is an opportunity for qualified medical research scientists to have a permanent career in the Navy's excellent medical research facilities.

(c) Title III establishes the strength of the Hospital Corps as 3.5 percent of the authorized Navy and Marine Corps enlisted strength. The Secretary of the Navy is authorized to appoint warrant officers in the Hospital Corps from the ratings of chief petty officers or petty officers first class. It is anticipated that the historic name of pharmacists mate will be changed to chief hospital corpsman; hospital corpsman, first class, second class, and third class; hospital man; and hospital apprentice.

(d) It is contemplated that a distinctive insignia will be created for each of the several sections of the Medical Service Corps.

Sincerely,



Rear Admiral, Medical Corps,
Surgeon General, United States Navy.

U. S. NAVAL MEDICAL BULLETIN

Vol. 47

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*"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"*¹

SPECIAL ARTICLES



CARE OF DEPENDENTS IN THE NAVY

MORTON D. WILLCUTTS
Rear Admiral (MC) U. S. N.

It is desired to stress that the subject of dependent care is a matter of great concern to the Bureau of Medicine and Surgery of the Navy, and it is felt that no greater morale factor exists in our Navy. Dependent care is not what it should be and presents at this time a rather gloomy picture, certainly an alarming and urgent situation.

Since VJ-day, the Bureau of Medicine and Surgery has been under stress due to the alarming and steady flow of resignations from naval medical officers and by the shortage of nurses and trained hospital personnel, both male and female. The War augmented the Navy Medical Corps by many highly skilled professional men, their services made possible the expansion of Navy dependent care, both of in-patient and out-patient type.

The high lights of the provisions and regulations governing medical care for dependents follow:

The provision of medical care for dependents of naval personnel by the Medical Department of the Navy appears to stem from the act of 5 July 1884 (23d Stat. 112) which reads as follows: "The medical officers of the Army and contract surgeons shall, whenever practicable, attend the families of the officers and soldiers free of charge."

¹ The policy of the U. S. NAVAL MEDICAL BULLETIN as printed on the cover of its first issue and maintained throughout the 40 years of its existence.

The 1913 edition of Navy Regulations provided that medical officers of the Navy would be required, in addition to their official duties, to attend the families of officers and enlisted men residing within a prescribed distance from Navy yards, naval stations, recruiting offices, and the Navy Department.

The Judge Advocate General of the Navy ruled on 26 January 1912 (File 28019-17) :

There is no provision of law which prohibits professional attendance by medical officers upon families of officers of the naval service, and if such attendance does not interfere with the necessary service to officers and men of the Navy and Marine Corps, it is not contrary to law.

Again in 1924 (CM07-1924 PP6)

Held: The law under which the Army provides hospitalization for dependents of officers and enlisted men is the Act of July 5, 1884 (23d Stat. 112). Under this Act, the Army for forty years has been rendering hospital treatment to dependents of officers and enlisted men. The same law (the Act of July 5, 1884) is applicable to the Army and to the Navy ; therefore, it must be conceded that the Navy needs no more congressional authority than does the Army in order to extend hospital treatment to dependents. Certain changes in Navy regulations should, however, be made.

Prior to 1935 medical care for dependents was provided, for the most part, on an out-patient basis. Those cases requiring in-patient care were hospitalized in civilian hospitals; the dependents bearing the expense of hospital accommodations and being attended by medical officers of the Navy.

In 1935 the first dependents' in-patient facilities were made available in a few hospitals under a plan whereby all expenses incurred in connection with the admission of such dependents to naval hospitals would be paid by Ship's Service Store funds. The per diem charge for in-patient care under this plan was \$3.75. Of this amount, 75 cents per diem for subsistence was deposited to the credit of the naval hospital fund. The remaining amount of \$3 per diem was deposited to the Ship's Service Store fund. The legality of this plan was favorably endorsed by the Judge Advocate General of the Navy in 1935 (CM010-1935 PP13). This plan was subsequently extended to all naval hospitals in which a separate ward could be established for dependents' medical care.

PUBLIC LAW 51—78TH CONGRESS

Chapter 95—1st Session

H. R. 1936

57 Stat. 80

AN ACT

To provide for the expansion of facilities for hospitalization of dependents of naval and Marine Corps personnel, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of expanding facilities for the hospitalization of dependents of personnel of the Navy and Marine Corps, and others as herein provided, there is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of \$2,000,000.

SEC. 2. The hospitalization of dependents of naval and Marine Corps personnel at any naval hospital shall be at such per diem or other rate as may be prescribed from time to time by the President and all sums received in payment of such hospital charges shall be deposited to the credit of the appropriation or fund for the maintenance and operation of naval hospitals.

THE LAW DEFINED

SEC. 3. The term "dependents" shall include a lawful wife, unmarried dependent child (or children) under twenty-one years of age, and the mother and father of a member of the Navy or Marine Corps if in fact such mother or father is dependent on such member. The term "child (or children)" shall include a natural or adopted child or stepchild. The widows of deceased naval and Marine Corps personnel shall be entitled to hospital care in like manner as dependents.

SEC. 4. In addition to those persons, including the dependents of naval and Marine Corps personnel, now authorized to receive hospitalization at naval hospitals, hospitalization and dispensary service may be provided at naval hospitals and dispensaries outside of the continental limits of the United States and in Alaska, to the officers and employees of any department or agency of the Federal Government, to employees of a contractor with the United States or his subcontractor, to the dependents of such persons, and in emergencies to such other persons as the Secretary of the Navy may prescribe: *Provided*, That such hospitalization and dispensary service to other than the dependents of naval and Marine Corps personnel shall be permitted only where facilities are not otherwise available in reasonably accessible and appropriate non-Federal hospitals. The charge for hospitalization or dispensary service for persons other than dependents of naval and Marine Corps personnel as specified in this section shall be at such rates as the President shall from time to time prescribe, and shall be deposited as provided in section 2.

SEC. 5. Hospitalization of the dependents of naval and Marine Corps personnel and of the persons outside the naval service mentioned in section 4 of this Act shall be furnished only for acute medical and surgical conditions, exclusive of nervous, mental, or contagious diseases or those requiring domiciliary care. Dental treatment shall be administered only as an adjunct to in-patient hospital care and shall not include dental prosthesis or orthodontia.

SEC. 6. During such periods as the Coast Guard may operate as a part of the Navy, the provisions of this Act shall apply to dependents of personnel of the Coast Guard in like manner and to the same extent as to dependents of personnel of the Navy and Marine Corps.

Approved May 10, 1943.

Section II of Chapter 1, Part IV of the Manual of the Medical Department provides regulations for the medical care and treatment of civilians and other supernumeraries. I quote:

In-patient Service.—Dependents of Navy personnel shall be provided hospitalization at naval hospitals designated by the Surgeon General and approved by

the Secretary of the Navy. Medical Department activities within the United States other than naval hospitals may be authorized by the Bureau to institute in-patient care for dependents of naval personnel provided: (a) The activity is in an isolated locality or where civilian hospital facilities are unavailable or inadequate; (b) adequate and properly segregated naval facilities are available; and (c) such care can be accomplished by the Medical Department personnel on duty.

It is further instructed that—

The medical officer in command or the senior medical officer of the Medical Department facility concerned shall determine availability of suitable accommodations and the need for hospitalization.

Dependents admitted for in-patient treatment shall be entitled to all intramural medical and hospital services, including blood transfusions. The services of civilian specialists or the furnishing of prosthetic, orthopedic, or other appliances is not authorized at Government expense. Drugs and materials shall be issued only on the prescription of a naval medical officer or naval dental officer for use or administration under his supervision. No medical stores shall be issued on the prescription of civilian practitioners.

Out-patient Service.—Dependents of naval personnel shall be provided out-patient service at naval hospitals, dispensaries, and other Medical Department activities where facilities for such service exist.

The per diem rate for the hospitalization of dependents is \$1.75 established by Executive Order No. 9411, pursuant to Public Law 51—78th Congress. This rate still holds, although at the beginning of this fiscal year the hospital rate for supernumeraries other than dependents was established as \$8.75 within the continental limits, \$5 outside. Attached is a survey of dependent care. The size of the figures are astonishing and show the tremendous volume of medical service rendered to dependents.

The allowances of Medical Department personnel are authorized by law as follows:

Medical Corps.....	0.65% of total Navy and Marine Corps.
Dental Corps.....	0.2% of total Navy and Marine Corps.
Medical Service Corps ..	20.0% of total Medical Corps officers.
Nurse Corps.....	0.6% of total Navy and Marine Corps.
Enlisted.....	3.5% of total enlisted Navy and Marine Corps.

It is noted that dependent patients are not included in the above percentages.

The formula developed for planning beds for dependents is based on the fact that the Bureau of Naval Personnel's experience data indicates that 90 percent of the active duty personnel have one dependent. Bureau of Medicine and Surgery then uses the requirements adopted for rural communities of 4 beds per 1,000 persons. This is considered to be a minimum and is usually far from adequate. Primarily, the limiting factor determining the number of dependents that can be hos-

pitalized in naval hospitals is the nonavailability of personnel to care for them rather than a lack of beds.

Today we are faced with budgetary cuts and medical personnel shortages that render mandatory the sharpest curtailment of all dependent care.

Based on Navy and Marine Corps personnel as authorized by Congress in H. R. 3493 the following will be the authorized Medical Department personnel for the fiscal year 1948:

Medical Corps.....	3, 092
Dental Corps.....	952
Medical Service Corps.....	618
Nurse Corps.....	2, 854
Enlisted.....	14, 910

We definitely need 3,000 medical officers to support the active lists of the Navy and Marine Corps and to render authorized care for our retired personnel and dependents. We have that number aboard today, but only 1,100 are Regulars, approximately 2,000 being V-12 medical officers. All but approximately 1,000 of this latter group will have completed their obligated service prior to July 1948. This will leave only 2,200 medical officers aboard at that time (July 1, 1948) unless procurement is stimulated by recent legislation. The V-12 medical officers are all graduates of Class A medical schools, all have had excellent internships. They are good doctors, but are inexperienced in the art of medical practice especially when such is compulsory obligated service. The situation in the Dental Corps is also acute, but in less degree. The strength of the Nurse Corps is more than one-third short. This is very serious as female attendance is essential for dependent care. The WAVE Bill failed of passage at the last session of Congress, but is still under consideration.

The Surgeon General proposes to recommend to Congress legislation that will remove restrictions on dental treatment for dependents to bring dental treatment up to the broad scope of general medical care. Also, to broaden the term of dependent to include the children of the widows of deceased naval and Marine Corps personnel now excluded from authorized dependent care.

The Operating Force Plan may permit the roll-up and reductions in medical facilities. The closing of hospitals and the consolidation of dispensaries would release medical personnel. Today, we are still operating 32 naval hospitals; there are 122 dispensaries located in the continental United States and 61 overseas.

Commandants know well their District medical facilities and current needs. They are fully cognizant of their dependent personnel, both active and retired. This is a serious, desperate situation in medical logistics, not only for dependent care but for the active and retired

lists if we are to regain lost ground and continue the medical service to dependents on the level that the Congress intended.

Demands on medical facilities for dependent care expand with the availability of good medical service. Make possible early, orderly medical appointments, have available medical and surgical beds, and there will result a tremendous boom in dependent care. The curves of our statistical charts will match the violent fluctuations noted in the spirals of inflating economy.

The situation is not good but it is far from hopeless. Navy medical and dental care should be on a par or superior to that in civil life. We have an over-all medical plant with supplies and inventories that exceed in total value one-quarter of a billion dollars. The medical equipment is of the very highest grade. We need desperately career medical officers. The active Navy list must be kept in fighting health, the retired list and all dependents rate and deserve our finest efforts. We give you two practical methods to insure this:

(1) The Inducement Bill (S. 1661).—Congress has just passed an increased allowance of \$100 per month for medical and dental officers. Our most fertile field for procurement of medical officers is the V-12 group. As stated above, we need 3,000 medical officers, we will get down to approximately 2,200 unless we can sell this new inducement to 800 of the first V-12 group, who will complete their obligated service next spring. The Bureau is preparing an active drive, but must depend upon those in the field to make it a success.

TABLE 1.—*Medical care of dependents in continental United States—September 1946*¹

[33 hospitals and 103 dispensaries]

Naval districts	Out-patient visits and examina- tions	Hospital admissions	Medical Department Personnel		
			Medical officers and interns	Nurses	Hospital corpsmen
First	5,212	337	27	28	75
Third	2,508	239	12	23	25
Fourth	2,604	186	10	23	26
Potomac River and Severn River Naval Commands	23,613	518	53	62	199
Fifth	9,030	469	29	45	68
Sixth	2,347	175	7	10	21
Seventh	5,096	284	13	33	63
Eighth	6,044	335	16	15	63
Ninth	2,481	135	17	19	43
Eleventh	28,449	1,530	57	104	155
Twelfth	9,940	540	33	53	110
Thirteenth	4,145	286	18	17	53
Total	101,469	5,034	292	432	901

¹ Births: Total number, 2,079; in naval hospitals, 1,850; in civilian hospitals, 229.

TABLE 2—*Medical care of dependents in Continental United States—April 1947*¹

[29 hospitals and 86 dispensaries]

Naval districts	Out-patient visits and examina- tions	Hospital admissions	Medical Department Personnel		
			Medical officers and interns	Nurses	Hospital corpsmen
First.....	10, 118	368	18	26	68
Third.....	7, 489	177	8	19	6
Fourth.....	6, 476	143	9	19	20
Potomac River Naval Command and Sev- ern River Naval Command.....	28, 017	454	70	56	187
Fifth.....	14, 023	630	22	51	52
Sixth.....	3, 607	111	7	8	19
Seventh.....	7, 031	231	5	23	38
Eighth.....	9, 053	279	13	14	54
Ninth.....	4, 290	140	10	13	34
Eleventh.....	28, 658	1, 093	44	85	140
Twelfth.....	13, 047	431	24	42	63
Thirteenth.....	7, 629	334	13	25	50
Total.....	139, 438	4, 771	243	381	731

¹ Estimated number of visits and examinations of out-patients for 1947, 1,840,581; hospital admissions, 57,252.

(2) Curtail dependent care to serious cases—by that I mean obstetrical service, urgent surgical and medical diseases. Repeated medical surveys indicate that 85 percent of dispensary calls and general medical cases will respond to home and common-sense corrective measures.

Perhaps the current, much publicized British “austerity” plan of living may apply here.

TABLE 3—*Births attended by naval medical officers*

1947	Total	Naval hospitals	Civilian hospitals
January.....	1, 774	1, 642	132
February.....	1, 541	1, 484	57
March.....	1, 648	1, 558	90
April.....	1, 499	1, 434	65
May.....	1, 486	1, 439	47

TABLE 4.—*Medical service rendered to other than active duty naval personnel*

Retired list of the Navy:

Officers.....	10,680	
Enlisted.....	16,837	
Nurses.....	458	
		27,975

Retired list of the U. S. Marine Corps:

Officers.....	1,648	
Enlisted.....	1,308	
		2,956

Estimated number of Fleet Naval Reserve, inactive.....	12,948
Estimated number of Fleet Marine Corps Reserve, inactive.....	716
Estimated number of dependents of active military personnel—Navy and Marine Corps.....	471,600
Estimated number of dependents of Navy retired personnel—officers and enlisted.....	24,765
Estimated number of dependents of retired U. S. Marine Corps personnel—officers and men.....	2,660
Estimated number of dependents of inactive Fleet Naval Reserve.....	11,653
Estimated number of dependents of inactive Fleet Marine Corps Reserve.....	644
Natives in western Pacific islands.....	78,000
Estimated average number of civilian employees.....	350,000
Veterans' Administration hospital patients daily average of 3,302 which represents hospital care for a VA population of.....	157,238
Estimated number of Diplomatic and Consular Service examinations (not to include several thousand inoculations and vaccinations).....	2,500
Medical advisory service for Members of Congress.....	531
Grand total.....	1,144,186

VAGOTOMY IN THE TREATMENT OF PEPTIC ULCERS

EDWARD S. LOWE
Captain (MC) U. S. N.

Section of the vagus nerves supradiaphragmatically in treatment of selected cases of peptic ulcer has been done in the surgery department of United States Naval Hospital, Aiea Heights, T. H., during the past several months. Herewith is presented a preliminary report on the first 12 consecutive cases, a discussion of the operation, impressions of its value, and a résumé of these cases to indicate the experience of the surgeons at this hospital with it.

Dragstedt (3) (4) and his coworkers (5) (6) (14) (15) deserve the credit for furthering our knowledge of gastric physiology and for developing the operation of vagotomy in the treatment of peptic ulcers. They further deserve credit for stimulating interest in this operation (7) (9) (11) (12) and in the anatomy of and the surgical approach to the vagus nerves (2) (10). Whether or not this operation withstands the proof of time and is generally accepted by the profession, their work and that of others stimulated by them is bound to contribute to our total knowledge of the functions of the stomach and the surgical treatment of that important organ.

The therapeutic rationale for vagus nerve section in the treatment of peptic ulcers is based on the following concepts arrived at by Dragstedt and his associates on the basis of experimental work in the laboratory and clinical observations (3) :

(1) Pure gastric juice has the capacity to destroy and digest various living tissues, including the wall of the stomach, duodenum, and jejunum.

(2) Gastric secretion does not digest elements of the alimentary tract under normal conditions because the factor which acts as a stimulus to the secretion of gastric juice also acts to dilute and neutralize the gastric secretion and decreases its corrosive powers. In normal individuals the gastric secretion between meals (i. e. when the stomach is empty) is of such a small amount that it is buffered by the saliva, pyloric mucus, and the regurgitated duodenal contents.

(3) The abnormal physiology in ulcer patients is that they produce large amounts of gastric juice in the intervals between meals, particularly at night when the stomach is empty and lacking adequate buffers.

(4) Section of the vagus nerves decreases the gastric secretion to between a fourth and a third of normal level, and decreases the quantitative amount of hydrochloric acid secretion; thus removing the factors which may cause ulcers and prevent their healing. It does not decrease the humoral (histamine, caffeine) secretory response of the stomach.

(5) Successful medical treatment depends upon keeping the gastric secretion neutralized throughout 24 hours of the day; surgical treatment depends upon either removing the secretory portion of the stomach (resection) or decreasing the amount of neurogenic secretion (vagotomy).

It is realized that all cases of duodenal ulcer are not candidates for vagotomy. Allen and Welch (1) estimated that between 10 to 15 percent of duodenal ulcers coming into a general hospital will require surgical treatment. In naval and military personnel, the percentage requiring surgical intervention will be greater because of the difficulty of obtaining selected diets under service conditions. The cases in which we have done vagus sections were treated by this procedure because of chronicity of the ulcer symptoms, failure to respond to adequate medical treatment, refusal or inability of patients to maintain the required rigorous medical regime, presence of marginal ulcer in gastro-enterostomy, and because of the severity of the lesion in young patients as evidenced by early perforation. We concur in the opinion that vagus section should not be done at the time of repair of an acute perforation because all efforts at such a time should be directed toward saving life and the added operative procedure is not warranted nor is opening the mediastinum through a septic field justifiable.

The operation should not be done in cases evidencing psychogenic symptomatology—the patient should have an ulcer, and the ulcer symptoms should respond to alkali therapy. Vagotomy cannot be expected to cause an acute massive hemorrhage to stop; hence should not be employed with that expectation. Further, it will not in itself relieve cicatricial obstruction; hence if one wishes to employ vagotomy in this sort of case, he must combine vagotomy with an operation directed toward relieving the obstruction, either some sort of pyloroplasty or gastro-enterostomy. We have employed vagus resection because the physiologic rationale seems sound, because of favorable results obtained by various large reputable clinics (3) (8) (11) (12) (13), and because of our reluctance to sacrifice as large and important an organ as the stomach in the treatment of duodenal ulcer unless there is no other satisfactory alternative. Furthermore gastrectomy for duodenal ulcer is not entirely satisfactory in treatment of this lesion. Allen and Welch (1) report 83 percent of cases being excellent in their response, 6 percent satisfactory, and 11 percent being poor with an operative mortality of 5.1 percent.

In these 12 cases we have employed the supradiaphragmatic approach as described by Dragstedt (3), entering the left chest through the eighth or ninth rib bed, clamping, cutting, and suturing the inferior pulmonary ligament, mobilizing the inferior portion of the left lung superiorly, and dividing the parietal pleura over the esophagus. The approach may be made in a like manner through the right chest. The vagus nerves are identified by vision or palpation with or without

mobilizing the esophagus, are ligated with cotton and divided distally, and the proximal free ends are rotated through 180° and sutured into the left pleural cavity. The anatomy of the nerves and the connections between them is variable; hence it is important to search for and resect the anastomosing fibers. The parietal pleura is closed, and the chest is closed without drainage, instillation of penicillin, irrigation, etc. As the final sutures are being placed to accomplish an airtight closure of the incision, the lung is expanded by the anesthetist to completely fill the thoracic space, thus precluding pneumothorax. In all of the cases the intercostal nerve of the resected rib was tied and divided centrally to minimize postoperative pain; and in the last eight cases we have injected with alcohol posteriorly the nerves above and below the nerve of the rib resected. We have had no occasion to employ the technic of vagus nerve section by the approach from below the diaphragm as described by Dragstedt (3), but would have no hesitancy should the indication arise to employ this approach. All cases are sent to surgery with a Levine tube in the stomach. This tube is left in place for 3 or 4 days to avoid regurgitation of gastric contents at operation or for the first few days postoperatively, as we know that the stomach becomes atonic following section of the nerves, and its motility is decreased. Needless to say, all transthoracic work is done under intratracheal anesthesia.

Transthoracic vagotomy is a much less formidable operation than is gastric resection. All of our patients have been ambulatory on the evening of the day of operation, and have not been the surgical, nursing, or feeding problems that our resection cases are. Technically it is not a difficult procedure for surgeons qualified in intrathoracic work. Our cases have been operated on by five different surgeons; however with either the chief of surgery or the assistant chief of surgery being a member of the operative team in each case. There has been no mortality in this series of cases, and only one complication and that of minor extent. Case No. 8 had a left hemothorax (nonseptic) which required needle aspiration twice, following which he made an uneventful recovery.

In none of these cases has there been experienced any ulcer pain or distress whatsoever from the time of recovery from anesthesia; this despite the fact that the vagi do not carry sensory fibers which reach a conscious level. The immediate lasting relief is explained on the basis of decreased gastric spasm and motility. The postoperative complaints of these patients have been of two sorts, one referable to the operation in the chest and the other to the stomach. The complaints referable to the chest were pain in the operative site, difficulty in mobilization of the left upper extremity, and intercostal nerve pain. We have attempted to prevent these complications by shortening the

incision and amount of rib resected, working through the eighth or ninth rib bed rather than higher in order to avoid the inferior angle of the scapula as far as possible, and injecting with alcohol the intercostal nerves above and below that accompanying the rib resected. The fact that our recent patients with one exception have had less chest and nerve pain and have regained the use of their left upper extremities more readily than the early cases indicates that these efforts are directed along correct lines. In none of the cases have these factors been disabling or amounted to really more than an inconvenience or nuisance. Only one case required postoperative intercostal nerve injection.

Of the complaints concerning the stomach are those resulting from atony and dilatation, the patients complaining of a sense of fullness and inability to eat full-sized meals. This has been transitory and has not persisted beyond 1 to 2 months. In each case, the patient has indicated that he is satisfied with the operation and that his food tolerance and nutritional status have improved. Each patient to whom vagotomy has been recommended (other than the first case in the series) has been advised to talk with the patients who have already had a vagotomy in an effort to make up his mind concerning the procedure. Apparently the operation is favorably recommended by the patients who have had it to the patients who are considering it as no patient to whom the operation has been offered has refused it.

CASE REPORTS

*Case 1.*¹—D. E. C., Lieutenant Commander (CEC) U. S. N. R., a white male 41 years of age giving an ulcer history of 1 year's duration was readmitted to this hospital after being at duty for 7 weeks following a period of 2 months' hospitalization for duodenal ulcer. In the 7 weeks since his previous hospitalization, his ulcer symptoms had recurred and were becoming progressively more refractory to control by diet and alkalis. He was having both day and night pains. He had had one bout of hemorrhage 9 months previously. As his separation from the naval service was imminent, and his ulcer symptoms were of such severity as to interfere with his pursuing his profession as a civil engineer and supporting himself and his family, this patient wished something done for him other than the prescription of diet. The presence of a duodenal ulcer was confirmed by x-ray examination on 7 August 1946. His fasting free hydrochloric acid was 42 units. On 7 October 1946, a transthoracic supradiaphragmatic vagotomy was done. Recovery was uneventful, the patient becoming ambulatory on the evening of operation. He experienced no ulcer pains from the time of recovery from his anesthetic. Postoperative x-ray pictures gave no evidence of ulcer. The patient left the hospital to subsist out after 9 days, and was discharged to work 1 month from date of operation. When last seen 6 months after operation, the patient was in good nutritional state, and was satisfied with the results he obtained from operation. His only complaints were immediately postoperatively when he had chest pain and difficulty in mobilizing his left arm. He eats an unrestricted diet and drinks an occasional cocktail.

¹ This was the first vagotomy done in the Hawaiian Islands.

Case 2.—C. N. B., radarman, third class, a white male of 22 years was admitted with a perforated duodenal ulcer and giving a history of ulcer symptoms of only 4 days' duration before perforation. Despite early operation a subdiaphragmatic abscess formed. This was drained and the patient recovered. A G-I x-ray series made after 5½ weeks revealed the presence of an active duodenal ulcer. Gastric analysis showed a free fasting HCl of 68 units. A transthoracic supradiaphragmatic vagus nerve section was done on 19 November 1946. Following operation he made an uneventful recovery other than complaining of pain on attempting to use the left arm and of gastric distension. X-ray made 2 weeks postoperatively showed an atonic distended stomach with residue of sufficient amount to dilute the barium to such an extent that no detail particularly of the ulcer could be made out. A gastro-intestinal series made on 3 January 1947 showed no evidence of ulcer but delayed gastric emptying estimated at 60 percent of retention after 2 hours. He gained in weight and strength. He lost the sensation of gastric fullness and regained the complete use of his left arm and shoulder and was returned to full duty 2 months postoperatively. He was again seen in the last week of April 1947 at which time his nutrition was good, and his stomach was functioning well; however, he stated he had three minor attacks of nausea and vomiting 2 weeks previously. Gastric analysis showed zero fasting free HCl, and the G-I series showed a scarred, deformed nontender duodenal cap, but no evidence of active ulcer. The barium passed into the duodenum without delay. There was a 60 percent gastric residue at the end of 2 hours. As he had no complaints, was feeling well, and was in a good nutritional state, he was returned to duty.

Case 3.—O. G. K., aviation radioman, first class, a 24-year-old white male was admitted with a perforated gastric ulcer and ulcer symptoms of 1 year's duration. He was taken to operation and the ulcer repaired and abdominal toilet performed. He made an uneventful recovery. Study showed 27 units of fasting free HCl by gastric analysis. On 20 November 1946 a transthoracic supradiaphragmatic vagotomy was done. The first postoperative x-ray made after 2 weeks showed gastric retention, immobility, and dilution of the barium with gastric residue. X-ray after 2 months showed no evidence of ulcer. At this time the patient had no gastric difficulty other than a sense of fullness. He was eating a regular diet, and was in good nutritional condition. Gastric analysis showed zero fasting free HCl. He was discharged to duty after 2 months and when last seen was free of ulcer complaints, and was satisfied with the results of the operation.

Case 4.—P. L. G., a 54-year-old Filipino Veterans' Administration patient, gave a history of having peptic ulcers for 10 years, having had a gastro-enterostomy 6 years previously with only temporary relief, severe day and night pain for the past 2 years and inability to control the pain or to work or to stay out of the hospital. X-ray on 8 December 1946 showed a functioning gastro-enterostomy with a marginal ulcer. His fasting free HCl was 25 units. On 28 December 1946 a transthoracic supradiaphragmatic vagotomy was done. Because of the complaints of incisional pain in the previous patients, the intercostal nerves above and below the incision were injected with alcohol. This patient had much less thoracic pain, and has had no ulcer pain since recovery from anesthesia. Postoperative gastric analysis showed zero fasting free HCl. This patient improved remarkably in his nutrition, and was discharged 6 weeks postoperatively with no complaints. He failed to return for follow-up.

Case 5.—L. W. R., water tender, second class, a white male of 25 was admitted Christmas Day 1946 with a perforated ulcer, the first symptoms of which were evidenced only 1 week previously. The perforation was repaired, and the patient made a good recovery only to have the ulcer symptoms recur. A gastro-intestinal x-ray study revealed the presence of an active duodenal ulcer, and the analysis showed 20 units of fasting free HCl in the patient's stomach contents. On 20 January 1947 a transthoracic supradiaphragmatic vagotomy was done. The post-operative course was smooth. Gastric analysis after vagus section showed zero fasting free HCl. The patient had no ulcer pain or distress, and gained nutritionally. He was returned to duty after 2 months in good physical condition, but was given a dietary regime to follow; as x-ray examination on 20 March 1947 was reported "Ulcer duodenum with crater, probably active. Pylorospasm, Gastric retention." The ulcer had diminished in size by x-ray examination. In view of the clinical recovery, we wonder if the x-ray findings are not those of deformity of the duodenum from perforation and repair; however as we accept x-ray criteria at face value in the other cases before and after operation it is only fair to accept it similarly in this case, and to record this case as one in which vagotomy did not effect complete healing of the ulcer up to the time of discharge.

Case 6.—R. R. L., captain U. S. N., a white male of 44 years was admitted with an ulcer of the duodenum which had been giving him symptoms intermittently for the past 17 years. The ulcer could be controlled by rigorous diet, but symptoms evidenced themselves whenever he was unable to adhere to a strict diet, or whenever he unbent to participate even mildly in ordinary social behavior. He was tired of the ulcer. The presence of an active ulcer was proved by x-ray on 5 February 1947. Fasting free HCl was determined to be 7 units. A vagotomy employing the same technic as in the previous cases was done on 7 February 1947. The patient was up and about his room on the evening of operation, went to one of the other islands on leave after 9 days, and returned to duty 1 month postoperatively. Gastric analysis on 26 March 1947 showed zero fasting free HCl. He had no ulcer symptoms from recovery from anesthesia, tolerates a full diet, feels he is completely recovered, is entirely happy with the results of the operation, and is doing full duty in a responsible administrative capacity. Gastro-intestinal series on 2 May 1947 (3 months postoperatively) was reported a "negative upper gastro-intestinal tract."

Case 7.—K. W. P., CSK, a white male of 30 years was admitted as an emergency with ulcer distress of 2 months' duration culminating in perforation. At immediate operation, the presence of a perforated duodenal ulcer was confirmed, and it was repaired. He made an uneventful recovery, but had recurrence of ulcer symptoms while still in the hospital. Fasting free HCl was determined to be 29 units. On 18 February 1947, 12 days after repair of the perforation, the patient received transthoracic supradiaphragmatic section of the vagus nerves. He made an uneventful and satisfactory recovery and was returned to duty 20 days after the vagotomy. His fasting free HCl post-vagotomy was zero units, and x-ray on 20 March 1947 (1 month postoperatively) showed a deformed duodenal bulb, secondary to perforation and surgical repair, no crater, no spasm, and no subjective tenderness on manipulation under the fluoroscope. The patient was in a good nutritional state, and had no ulcer pains from the time of vagotomy.

Case 8.—J. R. J., chief boatswain's mate, a white male of 22 was admitted with an ulcer history of 3 years' duration and two periods of hospitalization previously, one for 60 days and the other for 45 days. On each of these occasions x-ray confirmed the presence of an active duodenal ulcer. The patient had been

able to control the symptoms fairly well until about 2 months previous to admission, at which time, while in a forward area where diet was impractical and impossible, the pain recurred and was present day and night. X-ray on 20 February 1947 in this hospital showed the presence of an active ulcer of the duodenum. Fasting free HCl was 28 units. Transthoracic supradiaphragmatic vagotomy was done on 7 March 1947. Following the operation, the patient had no gastric symptoms whatsoever, but noticed a shortness of breath when he attempted ambulation. Physical examination and chest x-ray disclosed the presence of fluid in the left chest, the side of the operation. This was aspirated on two occasions and found to be blood which was sterile. Following the aspiration, the lung re-expanded and the patient had no further difficulty. He gained weight and is highly pleased to be free of the ulcer pains. X-ray examination made 2 months postoperatively showed no defect of the duodenal cap. There was no subjective tenderness to manipulation of the bulb under the fluoroscope and passage of the barium into the duodenum was prompt. There was a 30 percent gastric retention after 2 hours. The patient was returned to duty 10 weeks after operation, free of ulcer pains and distress, eating a full liberal diet, in a good nutritional status thoroughly pleased with the operation.

Case 9.—R. L. B., Lieutenant Commander, a 48-year-old male, was admitted with an ulcer history of 17 years' duration. He had had three periods of hospitalization for the ulcer previously, and had obtained relief by diet on each occasion; however because of the demands of the service and his inability to stay on a diet and because of his mode of living, the ulcer symptoms recurred repeatedly. On admission he was having day and night pains. X-ray examination on 11 March 1947 showed the presence of an active ulcer in the duodenal cap. His fasting free HCl was reported zero with a maximum of 65 units under the stimulation of the alcohol test meal. A transthoracic supradiaphragmatic vagotomy was done on 21 March 1947. Following the operation the patient has had no ulcer pains or distress whatsoever despite liberal smoking of cigarettes, mild partaking of alcohol, and eating an unrestricted diet. His postoperative gastric analysis showed a fasting free HCl of zero units. He was returned to duty 2½ weeks postoperatively. This officer had considerable chest pain requiring injection of the intercostal nerves on two occasions. Gastro-intestinal series 2 May 1947 (6 weeks postoperatively) revealed a normal appearing nontender duodenal bulb and gastric retention of 10 percent after 2 hours. He had gained weight, looked good, and stated he felt the best he had for years.

Case 10.—R. N., sergeant, U. S. M. C., a white 27-year-old male, was admitted with a perforated ulcer the symptoms of which had existed for only 4 days. The perforation was repaired immediately. As the patient convalesced in the hospital under close supervision and dietary control, the ulcer symptoms recurred. His fasting free HCl was 25 units. X-ray examination on 19 March 1947 showed the presence of an active duodenal ulcer. A transthoracic supradiaphragmatic vagotomy was done on 24 March 1947. He had an uneventful convalescence other than a slow recovery, and complained frequently of fullness and distress in the stomach. Postoperative gastric analysis showed zero fasting free HCl. At the end of 6 weeks, while awaiting a gastro-intestinal series, the patient voluntarily stated that he felt fine and requested to be sent to duty. The gastro-intestinal series made on 15 May 1947 (approximately 7 weeks postoperatively) showed marked delay in the progression of the barium into the duodenum, 50 percent gastric retention after 2 hours, and a nontender and nondeformed duodenal bulb. He was sent to duty at 7½ weeks postoperatively in good nutritional state, tolerating a full regular diet and having no stomach symptoms other than a sense of fullness.

Case 11.—R. J., a 43-year-old white female dependent, was admitted for vagotomy because of having duodenal ulcer symptoms of 10 years' duration which for the past 5 years were becoming increasingly more difficult to control with diet. She stated she had taken "barrels" of alkalis and antacid preparations. She was having day and night pains, and had repeated tarry stools. She was thoroughly tired of her ulcer. The presence of the duodenal ulcer was confirmed by x-ray on 21 March 1947. Her fasting free HCl was reported as 9 units. A vagotomy was done on 25 March 1947; her postoperative fasting free HCl was zero units, and she was discharged from the hospital to her home on the seventh postoperative day, fully ambulatory, eating a regular diet, and feeling entirely free from epigastric pain. On follow-up, she reported that her stomach felt the best it had in years, and that she wished that she had heard of the operation sooner. Gastro-intestinal series 5 weeks postoperatively showed the duodenal bulb well outlined with no evidence of ulcer, and not tender to palpation under the fluoroscope. The stomach was dilated and showed 90 percent gastric retention after 2 hours despite prompt passage of the barium from the stomach into the duodenum.

Case 12.—R. B., chief machinist mate, a 49-year-old white male who was on the medical service with epigastric pain of 12 years' duration, a proved duodenal ulcer of 2 years' duration, and a history of having been hospitalized twice before for the ulcer, upon watching the course of his friends who had had vagotomies, requested the operation. His ulcer was proved by x-ray on 20 March, 1947. His fasting free HCl was 48 units. A transthoracic supradiaphragmatic vagotomy was performed on 8 April 1947. He has had an entirely uneventful postoperative course with complete relief of the ulcer symptoms. Postoperative gastro-intestinal series made 2½ weeks postoperatively showed prompt passage of the barium into the duodenum, a nontender bulb, no evidence of ulcer, and a gastric residue of 15 percent after 2 hours. He was returned to duty after 5½ weeks free of pain and entirely satisfied with the operation.

DISCUSSION

In the 12 cases of peptic ulcer (10 duodenal, 1 gastric, and 1 marginal), treated by vagotomy reported herewith, all obtained striking, immediate, and lasting relief from ulcer pain and distress and all had no fasting-free hydrochloric acid on postoperative analysis. Ten of the twelve cases had no evidence of ulcer by x-ray in gastro-intestinal series made from 2½ weeks to 5 months postoperatively, one of the cases had evidence of ulcer; however the size of the ulcer was smaller, indicating healing, and one did not return for postoperative x-ray study. All of the cases obtained symptomatic relief and are satisfied with the results of operation, were improved nutritionally, and were returned to duty or work. Our impression is that better results are obtained in cases of long duration than in ulcer cases of short duration even though the ulcer was so severe that it perforated. There has been zero mortality and only one minor complication, that of the hemothorax in case 8 responding to two aspirations. None of the cases evidenced any side effects in the gastro-intestinal tract distal to the duodenum, such as looseness of the bowels as has been reported and which occurred in one of our later cases not reported in this series.

The majority of these 12 cases have complained of chest pain, difficulty in regaining the use of the left arm, and of skin paresthesias in the area of the thoracotomy incision and distal to it. The amount of complaint has varied greatly with the individuals depending somewhat upon the personality type of the individual concerned as well as upon the operative technic. We think there has been less complaint as our technic has been modified and improved.

A finding which has been universal in these cases, and which is highly variable in duration, lasting approximately 1 month on the average, is that of a sense of fullness and distention in the stomach and an inability to eat full-sized meals. Different patients have been bothered by this to different degrees, some complaining of it considerably, and others admitting to have it only upon direct questioning. None has claimed that this is worse than the ulcer, and all have accepted it readily as the lesser of two evils. This complaint does not persist as long as the atony of the stomach does as shown by x-ray. In studying the post-vagotomy x-rays in these cases, one is impressed by the degree of atony, distension, delayed emptying, and gastric retention which is had, and he wonders why these cases do not have more difficulty with nutrition, why they do not have regurgitation, and why they do not vomit.

We think that the advisability of employing this operation rather than resection in cases of gastric ulcer is open to question because of the factor of malignancy in gastric ulcers. We employed it in one case of gastric ulcer in a young individual who had ulcer symptoms of 1 year's duration, whose ulcer had been inspected at the time it perforated, who was in good nutritional status, who had a high degree of acidity in his stomach, and in whom we were sure that no malignancy was present. In cases of ulcer high in the stomach where total resection would be required, vagotomy is a safer procedure if sections from the ulcer show it to be benign.

We do not know how many of these cases could have been rehabilitated by other methods of treatment, but we do know that in this series of 12 severe cases of ulcer, all were returned to duty or their place in civilian life asymptomatic, eating a regular diet, in good nutritional status, and not needing to pamper their gastro-intestinal tract to such an extent as to forego many of the joys and delights of life.

These patients left the hospital from as early as the seventh post-operative day to as much as 2 months after operation. The patients held for 2 months were done so in order to permit us to observe them and to get follow-up studies before they left the sick list because of the difficulty experienced in getting them to return for further study once they are discharged. A patient who does not have to work can leave the hospital at 7 days, those doing light work can leave at about

2 weeks, and those who do heavy duty can be safely discharged at 1 month. Where the economic factor is a consideration, this early discharge from the hospital and early return to work has great advantage over prolonged treatment by diet and rest or by more formidable surgical procedures. The postoperative course is short and easy requiring a minimal amount of medical and nursing care.

SUMMARY AND CONCLUSIONS

From our limited experience with vagotomy in the treatment of peptic ulcers and from a study of the literature, we conclude that the procedure is based upon sound physiology, technically is not difficult, is accompanied by a very low mortality rate and few complications, stops neurogenic secretion of gastric hydrochloric acid, permits the ulcer to heal, and affords immediate and complete symptomatic relief from ulcer pain. The operation results in gastric atony and a sense of gastric fullness, both of which are of temporary duration, and chest pain is commonly complained of following thoracotomy. Patients recover rapidly, require a minimal amount of medical and nursing care, are ambulatory early, do not require rigorous dietary restrictions, and return to duty earlier and in better condition than following the more formidable operation of gastric resection with sacrifice of the stomach.

It is concluded that there is a definite place in naval surgery for vagotomy in the treatment of peptic ulcers in that the operation reha.itates these patients and restores them to duty status under circumstances where dieting is impracticable and impossible. Sufficient time has not elapsed to allow for evaluation of this procedure as to permanent results.

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PENICILLIN IN THE TREATMENT OF GONOCOCCUS INFECTION URETHRA

Report of Three Hundred Cases

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For 14 months, representing a period of operating and training on a United States heavy cruiser, liberty was granted in the United States and in ports of 11 foreign countries. A total of 289 admissions and 11 readmissions for gonococcus infection urethra was reported. Two hundred and ninety-nine cases were successfully treated with penicillin and 1 complication occurred.

This report includes the total number of patients treated for gonococcus infection urethra since the ship was commissioned on 4 September 1945 to 31 October 1946, inclusive. All cases treated represented contact exposures from Massachusetts, New York, England, Scotland, France, Gibraltar, Italy, Greece, Egypt, Ceylon, Singapore, and China. The treatment varied, by reason of the virulence of the disease and its resistance to treatment in different countries.

During the first 6 months there were 25 admissions for gonococcus infection urethra. Contact exposure during this period occurred exclusively in the United States. Liberty was granted in Cuba during the period, but no venereal diseases were encountered. All cases were successfully treated with 200,000 units of penicillin in 20,000-unit doses at 3-hour intervals, followed by 5 days' sulfonamide therapy (sulfadiazine 1 gram every 4 hours). There were no reactions, complications, or recurrences.

During the months of March, April, and May there were 86 admissions for gonococcus infection urethra. Contact exposures accounting for these cases occurred in England, Scotland, Gibraltar, France, Italy, Greece, Egypt, and Ceylon. The usual treatment with 200,000 units of penicillin failed to establish a cure in the majority of these cases and additional penicillin was required. A total of 400,000 units of penicillin, followed by 5 days' sulfonamide therapy, was found adequate in establishing a cure in all but 2 cases not responding to the initial 200,000 units. Two readmissions from this series occurred. They were treated as bed patients and remained symptomless after receiving an additional 400,000 units of penicillin (40,000 units

every 3 hours), with sulfonamide therapy (sulfadiazine 1 gram every 4 hours), and three anterior urethral instillations of penicillin, retained in the urethra for 1 hour (20,000 units every 4 hours). No reactions or complications occurred.

During the months of June, July, August, September, and October there were 178 admissions for gonococcus infection urethra. Contact exposures during this period occurred primarily in Tsingtao and Shanghai, China. A few cases were contracted at Singapore. Early in the treatment of this series of cases, 200,000 units of penicillin was found to be inadequate. Four hundred thousand units of penicillin, administered in 20,000-unit doses every 3 hours, followed by 5 days' sulfonamide therapy (sulfadiazine 1 gram every 4 hours), was adopted as routine treatment. Nine readmissions occurred during this phase. Of these nine, four had been inadequately treated with 200,000 units of penicillin at other activities, and were found to be infected upon reporting aboard this ship for duty. Four readmissions occurred following the routine treatment with 400,000 units of penicillin, and 5 days' sulfonamide therapy. These eight readmissions responded to additional penicillin and anterior urethral instillations. One readmission resulted in a complication. The case history is as follows:

CASE REPORT

A chief petty officer, age 25 years, was readmitted with gonococcus infection urethra, on 23 July 1946. He had three admissions with gonococcus infection urethra during the previous 4 months. His last admission had been on 11 July 1946. His symptoms had subsided after 200,000 units of penicillin had been received; however, a total of 400,000 units was administered. He was treated also with 5 days' sulfonamide therapy (sulfadiazine 1 gram every 4 hours). On 21 July 1946 he complained of a slight urethral discharge, painful heels, wrists, and ankles, and stiffness of both knees. His symptoms became more disabling and necessitated bed rest. The physical examination revealed: temperature, 99.2° F.; pulse, 84; and respirations, 20. The chest was clear and resonant throughout. The pulse was regular and full and there was no murmur, friction rub, or cardiac pain. Abdomen was negative. There was a slight serous urethral discharge. The prostate was normal in size and consistency and the prostatic secretion revealed less than 50 pus cells (high power field). There was definite swelling of the wrists, metacarpophalangeal joints, ankle joints, and metatarsophalangeal joints. There was pain on manipulation of the affected joints and pain on palpation of the os calcis bones. The knees were normal to physical examination. There was an erythematous skin manifestation of both lower legs and feet, which simulated an erythema nodosum. There was no demonstrable increase in joint fluid and x-ray examination of affected joints was negative. Urine analysis was essentially normal except for numerous pus cells. The red blood count was 4,300,000 and the white blood count, 10,900, with 65 leukocytes, 31 lymphocytes, 2 basophils, and 2 eosinophils. Sedimentation rate, 19 mm. fall in 1 hour. Urethral smears, with Gram's stain, revealed many pus and epithelial cells with extracellular gram-negative cocci, occurring in chains and pairs. On 27 July 1946 the urethral discharge was purulent and gram-negative intracellular diplococci, morphologically characteristic of *Neisseria gonorrhoeae*, were demon-

strated. 40,000 units of penicillin was given intramuscularly every 3 hours. On 31 July 1946 he had improved symptomatically and complained only of stiffness in knees. Penicillin was discontinued after a total of 1,400,000 units had been administered. On 2 August 1946 the erythematous skin manifestation recurred on both hands, forearms, and lower legs. The purulent urethral discharge recurred and *Neisseria gonorrhoeae* were again demonstrated. Facilities were not available for culture. Patient was transferred on 4 August 1946 to a hospital ship and later returned to the United States by reason of expiration of enlistment.

The supply of penicillin used in the treatment of this series of cases was obtained from the United States Naval Medical Supply Depot, Brooklyn, N. Y., and the United States Naval Medical Storehouse,

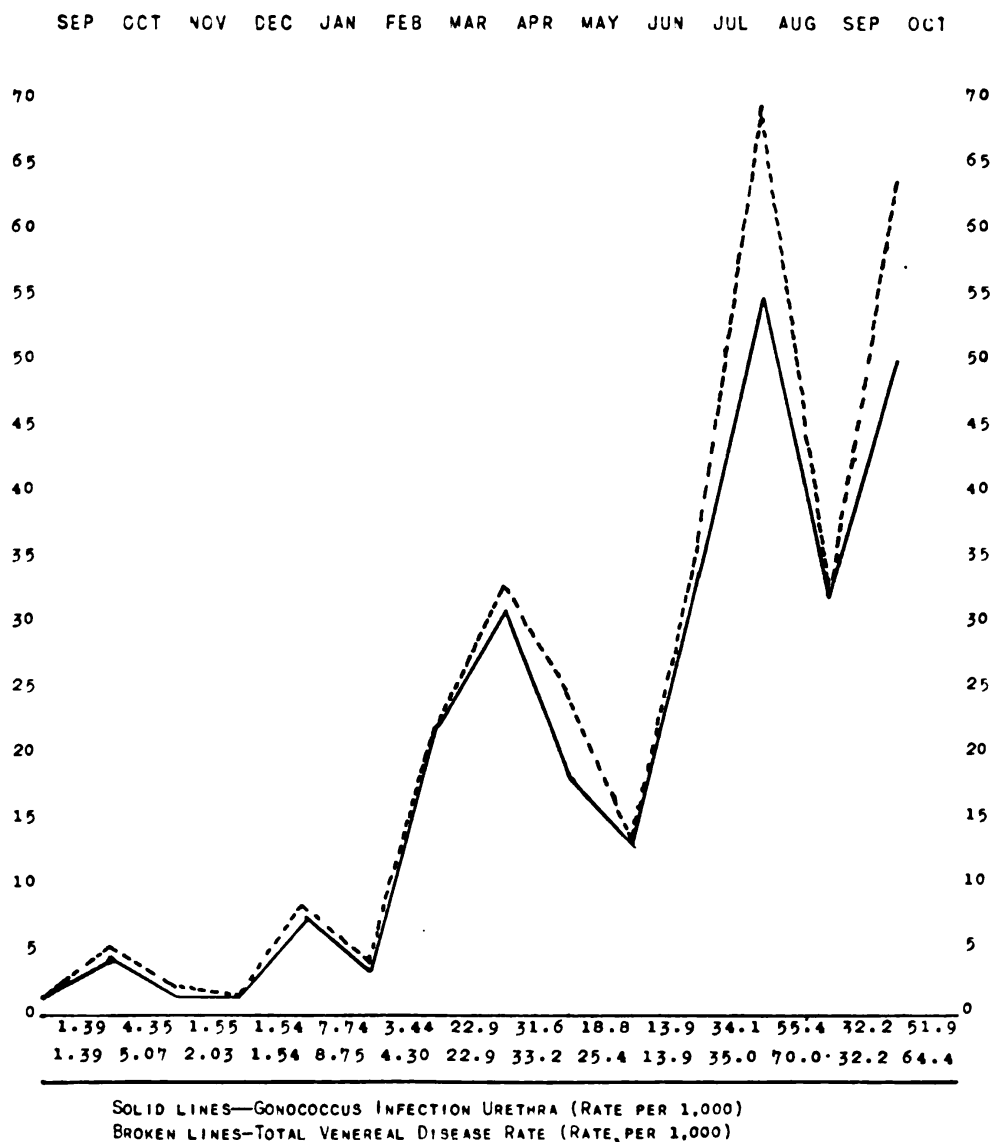


FIGURE 1.

Tsingtao, China. Other penicillin was obtained from the United States Army Fourteenth Port, Southampton, England, and the Medical Facilities, Royal Dockyard, Rosyth, Scotland.

The increase in number of admissions, for gonococcus infection urethra, during August, September, and October, indicated the need of a more rapid treatment. Having concluded that 400,000 units of penicillin was necessary in most cases to afford a cure, the following treatment was established. One hundred thousand units of penicillin (4 cc.) was given intramuscularly at 3-hour intervals, for four doses; and sulfonamide therapy (sulfadiazine 1 gram every 4 hours) for 5 days. This more rapid method of treatment has proved equally as effective. All patients are observed for 2 weeks following completion of treatment. Examination of the prostate gland and microscopic examination of the prostatic secretion is made on all patients, during this period of observation.

Figure 1 shows the venereal disease rate per thousand, during the period covered by this report.

Having treated with penicillin a total of 300 cases of gonococcus infection urethra, including 11 readmissions, occurring within a period of 14 months, and with known exposure contacts in 11 out of 12 countries where liberty was granted, the following comments are offered:

(a) The success in treatment of gonococcus infection urethra, with penicillin, depends significantly on an early diagnosis. To this aim a platinum wire loop should be used in obtaining urethral smears, and smears should be made frequently during the onset of symptoms.

(b) The onset of symptoms of gonococcus infection urethra varies from 3 to 15 days. This is particularly true in the Mediterranean area and in the Far East. Furthermore, the symptoms in these areas are frequently slight and go unnoticed unless frequent diagnostic urethral smears are obtained.

(c) Penicillin affords the best results in establishing a cure for gonococcus infection urethra when the incubation period is shortest. The majority of readmissions occur following treatment of the original disability which was characterized by a prolonged incubation period, minimal symptoms, or by some reason accounting for difficulty in establishing the diagnosis.

(d) Experience in the treatment of recurrences of gonococcus infection urethra, by means of anterior urethral instillations of penicillin, has not been employed on a sufficient number of cases to formulate a conclusion.

(e) In the treatment of 264 cases of gonococcus infection urethra encountered in foreign countries within 14 months, a total of 400,000 units of penicillin has proved adequate in 253 cases. Aiming to prevent recurrences and complications, this series of cases resulted in

the following recommended treatment: 100,000 units of penicillin (4 cc.) intramuscularly at 3-hour intervals for 4 doses. Sulfadiazine (1 gram every 4 hours) for 5 days.

(f) Less than 400,000 units of penicillin has proved inadequate in the treatment of gonococcus infection urethra at other medical facilities operating in the China area. Four such cases are a part of the series of 11 readmissions covered by this report.



DIETARY FADS

The story has been told of the celebrated Dr. Janeway that a younger colleague once referred a patient to him for examination. After the great internist had looked the man over, offered his diagnosis, and outlined a treatment, the patient asked what he should eat. "Eat anything you want," replied Dr. Janeway, "except creamed oysters." Overwhelmed with admiration at this perspicacity, but too awed to ask any more questions, the patient later inquired of his own doctor how any man could be such a genius as to know that a perfect stranger could not eat creamed oysters. The lesser medical light was honest enough to admit his own ignorance, but volunteered to ask the eminent one at the next opportunity. Dr. Janeway's reply was, "I ate some myself the week before and they damn near killed me!"

This answer contains the basis for much of the advice given about diet. Doctors and dietitians, both amateur and professional, are very likely to be influenced by their own personal biases in telling their patients what to eat and what to let alone—or, to make a poor pun, what to chew and what to eschew. It is fortunate for the human race that it can adapt itself to a wide variety of foods. Vegetarian faddists long ago demonstrated that meat can be dispensed with for a time, at least. More recently Stefansson and his companions lived for 9 months in the Arctic regions on meat alone. After the suggestion was made that the intense cold and their strenuous exercise enabled them to utilize more meat than would have been possible under ordinary conditions, he and his companions lived for a year in New York on an exclusive meat diet, with no increase in their usual amount of exercise. Complete physical examinations before and after the experiment indicated that they were in rather better condition at the end of the year than at its beginning.—JOHNSON, W. M.: Diet in older people. *Geriatrics* 1: 348-352, Sept.-Oct. 1936.

LOCAL PENICILLIN THERAPY FOR TROPICAL ULCER

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Several patients with tropical ulcer (tropical sloughing phagedena) were observed among Chinese coolies at a camp in Szechwan Province during the summer of 1945. A method of local penicillin therapy which appeared to produce good results was developed without knowledge at the time of previous work done by Hamm and Ouary (1).

The incidence of phagedenic ulcer is generally stated to be quite high in tropical and semitropical areas and it was estimated that almost 50 percent of the coolies in Szechwan were so afflicted. The economic impact of these ulcers and their complications can be sensed from Hamm's statement that in some localities they rank second only to malaria as a principle cause of death.

The etiology of tropical ulcer has not been definitely determined. Nearly all observers report the finding of spirochetes, fusiform bacilli, and secondary invading organisms. Smears obtained from the ulcers in the patients herein reported revealed Vincent-like organisms and innumerable assorted cocci and bacillary organisms. Marsh and Wilson (2) assert that dirt and trauma are essential etiologic factors, with malnutrition and systemic infection important contributing factors. They paraphrase these factors thus: "Filth, food, friction, fusospirochellosis." This was certainly true of the Chinese patients seen. Dirt and filth form an integral part of the coolie's life. The nature of his work—breaking stone, wading in the paddies, or bouncing a load on his "eitol" pole, along a narrow trail—provided ample opportunity for trauma about the feet and legs. Almost universally the patients were undernourished and some had obvious vitamin deficiencies. Nearly 100 percent of the patients had parasitic infestations of one or more kinds. Malaria and tuberculosis were common associated maladies.

Phagedenic ulcers were relatively easy to differentiate from other skin ulcers. The typical location seemed to be the anterolateral aspect of the foot or lower leg. Early lesions often resembled a small pimple; others suggested a minor abrasion or contusion which had become infected. Ulceration apparently proceeded rapidly up to an indefinite point, after which there seemed to develop a stalemate between the

ulcerative process and the scarring at the periphery. The skin border was raised and decidedly indurated. Often there was undermining for a centimeter or more. The ulcer bed was usually covered with necrotic material and the granulation tissue in the bed had an unhealthy appearance. The discharge was profuse, purulent, and foul.

Treatment in the past has been varied. Potassium permanganate, (3) hydrogen peroxide, iodoform, sodium iodide, acriflavine, azochloramid, antimony, arsenicals (parenteral and local), and the sulfa drugs all have been used with varying degrees of success (1).

These Chinese patients were, of necessity, treated as outcases. Hospitalization was not possible, due to lack of facilities, and because most of the patients could ill afford to lose a day's earnings.

When first seen in sick bay and after a diagnosis of tropical ulcer had been made, the initial therapy was cleansing of the affected extremity with copious amounts of soap and water. The ulcer was then irrigated with hydrogen peroxide and normal saline and as much necrotic tissue as possible was removed. A dry pressure dressing was applied, and the patient told to return daily for inspection and redressing.

Azochlorimid, zinc oxide ointment, and neoarsphenamine (both local and parenteral) were used on various patients. No definite improvement over that achieved by the simple "cleaning up" process was noted with these medications. Local application of sulfanilamide powder with each change of dressings did, however, in several cases produce a relatively clean wound with healthy appearing granulations and evidence of beginning epithelialization after 7 to 10 days.

Because of the inadequate or slow response to these therapeutic measures, it was decided to try local penicillin on some of the ulcers. After the initial cleansing of the ulcer, 100,000 to 200,000 units of dry penicillin sodium were sprinkled uniformly over the wound surface. A gauze strip impregnated with vaseline was placed over the wound to keep the penicillin confined to the depths of the defect, and a pressure dressing was applied. It was our observation that the dry, crystalline penicillin dissolved rapidly in the serum present in the recently cleaned wound. The gauze impregnated with vaseline prevented this concentrated solution from being absorbed by the dressing itself, and confined the antibiotic to the area in which the organisms were present in greatest numbers. The patients were seen at daily intervals thereafter, and further applications of penicillin made as necessary to obtain a clean wound.

In a series of 35 ulcers treated in this manner, the results were gratifying. With the exception of three cases the ulcers appeared clean, the granulation tissue assumed a healthy appearance, and the peripheral induration became significantly diminished in from 24 to

72 hours. Once the wound had become clean, it was possible to keep it so with sulfanilimide powder and dry dressings. Healing from the periphery was effected rapidly in those ulcers in which the original diameter did not exceed 5 to 7 centimeters.

In the three more resistant cases, similar though less dramatic results were achieved after 5 to 6 days' treatment with the penicillin. No ill effects were noted from applying the dry penicillin. A majority of the patients complained of local burning immediately after the application, but this disappeared after a few minutes.

What was perhaps the most interesting case in this series is cited in more detail.

CASE REPORT

The patient, a Chinese male of about 22 years, was a coolie on a road gang. His general physical condition was considerably better than the average. When first seen at sick call, there were numerous old and recent abrasions about both shins. On the medial aspect of the right leg, a short distance above the medial malleolus was a typical phagedenic ulcer about 6 by 9 cm. The patient could not state how long it had been present but he knew it was over a month old.



FIGURE 1.—Appearance of ulcer 2 weeks after grafts were applied.

The edges were raised about 0.5 cm. and were very firm. There was moderate undermining. The leg was scrubbed, the wound irrigated with peroxide, and penicillin, 100,000 units, applied with a pressure dressing. The lesion was much improved in 24 hours, and the penicillin was repeated. Subsequently the wound was dressed daily and sulfanilamide was applied locally. After 9 days, the indurated border had completely subsided, and there was definite beginning epithelialization. The granulation tissue had increased in amount and was healthy in appearance. On the tenth day a small number of "pinch" grafts were placed on the graulations. The patient had been working daily up to this point and he apparently continued to work after the grafts had been applied. However, 100 percent of the grafts took in spite of ambulation. Within 3 weeks after grafting there was complete epithelialization.

SUMMARY

1. A number of patients with tropical ulcer were observed among Chinese coolies in Szechwan Province.
2. Spirochetes and fusiform bacilli, along with other secondary infecting organisms were usually found in these phagedenic ulcers. Dirt, trauma, and debilitation seemed to be contributing factors.
3. A method of treatment employing dry penicillin crystals applied directly into the lesion was instituted and the results described.
4. A case report is included with detailed accounting of the therapy.

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RHEUMATIC FEVER IN THE NEGRO

JOHN M. VESEY

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A review of the literature reveals only occasional and frequently diametrically opposed references to the incidence and severity of rheumatic fever in the Negro. Lichtwitz (1) states: "Race seems to be unimportant in rheumatism." He further avers that sex and race are not significant factors in the development of heart disease from rheumatic fever. Paul (2), in his book, *Rheumatic Fever in New Haven*, quotes Hedley's observation "that the death rates from heart disease in young colored patients are higher than among young whites, both in the North and South. This susceptibility for the Negro is one of increased severity of the disease rather than of increased susceptibility to its acquisition. Rheumatic fever incidence is low for the Negro." Wedum and Wedum (3), however, after their survey in Cincinnati, believe that the Negro has a higher incidence and a more severe form of the disease than the white.

An excellent opportunity for the study of rheumatic fever is afforded at this hospital since the majority of naval rheumatic patients along the east coast of the United States eventually complete their convalescence here. The patient is brought here usually from 1 to 8 weeks after the onset of his disease. A careful résumé of his history and physical findings, as well as laboratory data and progress notes accompany him. If the disease is active, he is placed on a regime of salicylates (125 grains per day) and bed rest until clinical and laboratory evidence indicate quiescence of the rheumatic process. Then graduated activity under constant medical supervision is permitted for a period of about 3 months, until the patient is returned to duty or invalided from the service.

MATERIAL AND METHODS

Ninety-three case histories of Negro patients with the diagnosis of rheumatic fever have been reviewed. Approximately 75 percent of these patients were, at some stage of their disease, examined by the author and 50 percent were handled by him. Selection was based only upon the date of admission to this hospital with the view of comparing previously published series of white patients. The questions in mind when the charts were reviewed were as follows:

- (1) Is the Negro more susceptible to the acquisition of the disease than the white?
- (2) How long is the period before the rheumatic activity of the Negro patient ceases?
- (3) Is the incidence of organic heart disease following rheumatic fever higher and are the types of heart disease more severe?

INCIDENCE

Previous attempts have been made to compare the incidence of rheumatic fever but the process has necessarily been one of inference rather than of direct measurement. Hospital admissions have been reviewed and the number of Negro admissions compared with the white on the rheumatic service. Death rates from heart disease in young adults have been charted. Both of these methods, however, are subject to error, the former varying with the location of the hospital, the type of patients admitted and the number of patients in the community who were treated at home. The latter is incomparable because of the economic standing of the Negro which frequently forces him not to seek or to be unable to heed medical advice during active rheumatic fever.

A military or naval basic training camp would be the logical place to compare the rate of incidence in the services since most of the rheumatic fever originates in these places. This is probably due to the crowding that exists, the necessary indifference to climatic conditions during the training program, and the subsequently high incidence of hemolytic streptococcal infections. The best available figures show that during the years 1944 and 1945, in one of our large training camps, 269,917 men were processed. Of this group, 212,776 were white and 57,141 were colored. The men lived in the same type of buildings, had the same food and clothing, and underwent the same type of training with equal exposure to weather and fatigue. During these 2 years, from the total group, there were 435 cases of rheumatic fever or an incidence of just over 0.2 percent. Of these 435 patients, 395 were white and 40 were colored. The percentage incidence in the white was 0.138 percent and that in the colored was 0.07 percent, or twice as high among members of the white race as it was among the colored.

LENGTH OF RHEUMATIC ACTIVITY

Since all patients in this hospital are discharged approximately 3 months after the evidence of rheumatic activity has ceased, as outlined previously, the comparison of the number of days on the sick list was considered to be a fairly reliable index of the length of rheumatic activity. Of the 93 charts reviewed, the longest any Negro patient

remained on the sick list, that is, in the hospital, was 406 days. The shortest duration was 120 days and the average was 277.67 days. A group of white patients, who had similar dates of onset and were in this hospital during the period in which the Negroes were observed, were also reviewed. The average here was 210.84 days with the longest period being one of 483 days and the shortest 135 days. If this index is correct, therefore, the Negro requires more than 2 months longer than the white to overcome the disease, or at least, for the laboratory work by which activity is assessed, to regain normality. This is, at least, an indication that rheumatic fever in the Negro is more severe and requires a longer period of therapy.

INCIDENCE OF ORGANIC HEART DISEASE

As has been stated before, these patients were kept at this hospital for a period greater than 6 months and for approximately 3 months after cessation of rheumatic activity. It is probable, therefore, that the cardiac damage that was present on discharge will remain and that of those who were discharged with no cardiac disease, only a very small number will subsequently develop valvular lesions, presupposing, of course, that there are no further attacks of rheumatic fever. This is postulated on the work of Boone and Levine (5), who found the outlook was much more favorable in an intermediate age group, averaging 13.8 years of age and observed for 9.5 years; in only 4.8 percent of 166 patients with a history of rheumatic fever or chorea but with either a normal heart or a systolic murmur of not more than grade 1 intensity did signs of valvular deformity subsequently develop.

Although postulated on an error, i. e., that all patients who were inducted did not have valvular lesions, the incidence of cardiac disease, it is believed, will not be in error by more than 0.2 percent. Delaney et al. (6) found 100 cases of heart disease out of 45,000 men examined for the A. A. F., all of whom had been previously screened by physical examination. It is further believed that a comparison between Negro and whites can be made since the error will be present in both groups.

Of the total group of 93 patients there were 24 patients in whom there was evidence of valvular heart disease at the time of discharge. This is an incidence of 24.74 percent and is divided as follows:

<i>Lesion</i>	<i>Number</i>	<i>Percent</i>
Mitral insufficiency	17	70. 83
Mitral and aortic insufficiency	3	12. 50
Mitral stenosis	2	8. 33
Aortic insufficiency	1	4. 33
Mitral stenosis and insufficiency	1	4. 33

These figures are not in complete agreement with the findings of Manchester (8) in a similar age group. He found an incidence of

definite valvular lesions in only 7 percent, although there were 25 percent of his group who showed residual, slight, or moderate apical systolic murmurs transmitted to or beyond the anterior axillary line, and these he classed as having potential rheumatic heart disease.

W. S. Adams, former lieutenant, junior grade, (MC) U. S. N. R., in an unpublished survey conducted at this hospital, found an incidence of 18.1 percent with 60 percent exhibiting mitral insufficiency. This survey included the records of 1,430 patients, both white and colored, and agrees with the findings of various informal and not comprehensive studies of certain of the ward medical officers. The difference, therefore, is 6.1 percent and certainly is at variance with Hedley's (7) work since he found that in certain sections of our country the proportion of heart disease deaths between Negroes and whites was 2 to 1.

SUMMARY

It is believed that this is the first time that it has been possible to definitely measure the incidence of rheumatic fever in the Negro and to compare it with a similar group of white patients. The fact that the disease occurred twice as frequently among whites certainly agrees with Hedley's observation that the incidence is lower in the Negro.

The Negro patient spends about 2 months longer on the average than the white in recovering from his rheumatic fever. This is probably due to the increased severity of the disease in the colored race.

Organic heart disease following rheumatic fever was found to be more frequent in the colored race, although it is not believed that the 7 percent of Manchester (8) and our incidence of 25 percent are directly comparable because a number of his moderate apical systolic murmur heard at or beyond the anterior axillary line would probably have been called mitral insufficiency at this hospital. Rather, it is thought that the difference is probably around 10 percent as was found in the comparison with Adams' series.

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BENADRYL AS A THERAPEUTIC AGENT IN THE TREATMENT OF THE COMMON COLD

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During the past year Benadryl has been used experimentally as a therapeutic agent in the treatment of the common cold. To date it has been used in well over 100 cases. All have been outpatients treated in the dispensary set up for personnel of this staff. The results have been sufficiently encouraging, it is believed, to warrant publication and more extensive study.

Benadryl was originally developed as an antihistaminic agent for therapy of allergy and especially that form due to pollens and other air-borne allergens. Its palliative effects in colds were first noticed in a patient with an alimentary form of allergy, for which he was being treated with Benadryl. He contracted a cold while under treatment and to his and my own surprise and gratification the cold apparently was aborted. Believing that many of the so-called common colds have an allergic origin or at least an allergic factor, and from the experience of this first patient it was decided to use Benadryl routinely in all cases of common colds.

From the experience gained in the relatively few cases treated to date it has been found to have the following properties, which are useful in the treatment of colds: (a) It markedly inhibits the serous discharge from the respiratory mucous membranes to a degree equal to that of a conservative dose of atropine. (b) It produces a sedative effect equal to a therapeutic dose of phenobarbital in the majority of cases. The sleep thus induced is usually dreamless and thoroughly refreshing. It is rarely followed by the mental confusion or dizziness upon awakening that is occasionally experienced with the barbiturates or opiates. (c) In children especially, the cough reflex is inhibited and is due, it is believed to the elimination of the postnasal dripping. (d) It aborts herpes, the common fever blister, when taken immediately after appearance of the initial itching, burning wheal.

Thus, in this one drug the annoying symptoms of a cold are removed or largely controlled. There has been no evidence of an antipyretic effect. It has seemed to completely abort about 10 percent of the cases, and in the remainder it has eliminated the serous stage of the cold, the nasal discharge becoming mucous in character within 24 hours of the

onset. It has not prevented the secondary sinus infection once the cold has fully developed. No attempt was made to treat upper respiratory infections with evidence that the streptococcus or pneumococcus was the probable causative agent.

It is believed that a large proportion of the cases of the common cold, virus in origin, could be aborted by early and prompt treatment with Benadryl. By this it is meant it should be taken at the first sensation of soreness in the nasopharynx, the first engorgement of the nasal mucous membranes or whatever the individual has learned by experience means the initial symptoms of a developing cold. To be sure this is an ideal rarely to be attained. In a group as small and as closely knitted as this staff and in spite of attempts at education and encouragement this was rarely possible. To be effective one should carry a capsule of Benadryl with him constantly.

As used in this series of cases the dose for an adult was one 50-mg. capsule and for children under 12 years of age, 10 to 25 mg. The dose was rarely repeated more than once in 24 hours and that at bedtime. Ten grains of aspirin were given to adults with the night dose for its analgesic effect. In retrospect this seems to be ultra conservative but was designed for treatment of ambulatory patients. No deleterious effects were noted in or complained of by any patient in this series. That such are possible with large doses, especially with self medication and in rare instances of idiosyncracies, has been reported (1) (2) (3) (4). However, patients should be warned of its soporific effect and cautioned to avoid driving a car or operating potentially dangerous machinery while taking the drug.

SUMMARY

Benadryl has been used in the treatment of the common cold of virus origin in over 100 cases. It has been found to completely abort 10 percent of such cases and to shorten the course and afford marked subjective relief to 95 percent of all cases. This is due to its inhibiting effect upon the serous discharge from the mucous membrane of the upper respiratory tract and its soporific effect. It has proved to be the most satisfying single therapeutic agent for the treatment of the common cold.

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CLINICAL REPORT OF THE USE OF BENADRYL IN 100 CASES ¹

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The clinical use of Benadryl, an antihistamine and antispasmodic substance, was first reported in this country in April 1945 by Curtis and Owens (1). Since then, because of its effectiveness in urticaria and hay fever and because of its low toxicity, it has been used in a variety of conditions. Although its mode of action is not definitely known, it is supposed that Benadryl exerts its effect by having a greater affinity for the histamine receptor substance than histamine itself, thus displacing the latter from its site of action (2). This is a report of the clinical observations made on the first 100 patients treated with Benadryl on the dermatology service of this hospital.

The conditions for which Benadryl was prescribed are tabulated as follows:

	<i>Number of patients</i>
Dermatitis venenata (poison ivy)	25
Chronic urticaria	12
Acute urticaria, cause unknown	14
Acute urticaria, cause penicillin	20
Acute urticaria, cause streptomycin	1
Acute urticaria, cause trichophytin	1
Acute urticaria, cause sea food	1
Acute urticaria, cause merthiolate	1
Dermatographia	1
Atopic dermatitis	15
Psoriasis	1
Erythema multiforme	2
Hay fever	4
Scabies	1
Idiopathic pruritus	1

The results obtained in each of these groups are summarized in the following paragraphs. Unless otherwise stated the dosage employed was 50 milligrams taken orally three times a day.

¹ From the Department of Dermatology and Syphilology, U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md.

Dermatitis Venenata (Poison Ivy)

No attempt was made to classify the grade of the poison ivy cases as to extent or severity or to keep a control series. In general the mild, non-oozing cases were treated with lotions while Benadryl was reserved for patients with extensive lesions and areas of oozing. Of the cases treated, all but three were kept on Benadryl until the lesions had become dry and the discomfort has ceased. In the other three cases it was necessary to discontinue the Benadryl because of the accompanying unpleasant effects. Excluding these three, the average duration of the Benadryl treatment was 5 days. It is felt that this is a decrease in the time required to obtain similar results without the use of the drug. It was also observed that the patients seemed more comfortable while on Benadryl although the relief of itching was not nearly so marked as in cases of urticaria.

Chronic Urticaria

There were 12 cases of chronic urticaria treated, the duration of which prior to treatment varied from several weeks to several years. In some of these cases definite precipitating causes could be found, such as cold, hops, etc.; in some the attacks seemed definitely linked to an emotional state; while in others the cause was never established. All but two of these patients improved while on Benadryl. In the other two the drug seemed of no value. However, even in the 10 who responded, complete relief was not obtained even though in 5 of them the dosage was increased to 300 milligrams a day. The attacks, however, were less frequent, of shorter duration, and much milder than when the patient was not taking Benadryl. Upon discontinuing the drug the attacks recurred with their original intensity. In 1 case, after 40 days of treatment, it was possible to discontinue the drug permanently with only 1 transient attack during the 90 days the patient was kept under observation.

In these 12 cases there was no need for larger doses the second time the drug was administered. (Elias and McGavack (3), reporting on flare reactions, describe a phenomenon of "release" from the effects of Benadryl if it were stopped for a short period and then begun again.) Nor were there any cases of tolerance.

Acute Urticaria

All of the 14 cases of acute urticaria of undetermined cause became asymptomatic while under treatment with 150 mg. of Benadryl a day. The average duration of treatment was 3 days, although this represents in most cases a continuation of the Benadryl for a day or so after the symptoms had subsided. There was no recurrence in these cases when the drug was stopped and there was no need in any of them to increase the usual dose.

Penicillin Urticaria

Perhaps in no other condition is Benadryl so valuable as in the treatment of penicillin urticaria. On this service a number of patients are treated with penicillin and fever therapy for syphilis of the central nervous system—the routine being 20,000,000 units of penicillin over a 25-day period. Urticarias not infrequently develop before this treatment is finished. Benadryl, in most of these cases, begins to exert an effect within 15 to 30 minutes and eliminates the symptoms completely within a period of 24 to 48 hours. The penicillin treatment can thus be continued, usually without interruption. As a matter of policy the Benadryl is usually continued as long as the penicillin is administered, but in one patient it was possible to bring an acute urticarial attack under control and then to discontinue the Benadryl. In the cases of delayed penicillin reactions several days on the drug usually sufficed to eliminate the urticaria. Two patients observed had neuritic pains whenever started on penicillin. Benadryl did not relieve them.

Miscellaneous Urticarias

Benadryl was also effective in the other urticarias for which it was used, namely, those caused by streptomycin, trichophyton, merthiolate, and sea food. The usual dose was administered and the drug was discontinued after 2 to 5 days with no recurrence of symptoms. It did not improve one case diagnosed as dermatographia, however, even though continued for 14 days.

Atopic Dermatitis

There were 15 cases of atopic dermatitis. Only 2 of them were noticeably improved while on Benadryl. One of these required Benadryl for 11 days and the other for 39 days. Among the others, 4 patients stated that they received initial benefit from Benadryl in that their itching was considerably lessened. This might have been due to the hypnotic effect but has also been reported by other observers (4) (5) (6). There was no objective sign of improvement even when the dose was increased to 300 mg. a day and continued for months.

Miscellaneous

Of the miscellaneous conditions treated, Benadryl had no effect in the cases of erythema multiforme, scabies, psoriasis, or idiopathic pruritus, but it did bring relief in three cases of hay fever. A fourth patient with hay fever who was given Benadryl obtained initial relief which lasted only a few days. Increasing the dosage to 300 mg. a day also brought relief but again only for a few days. Two other

patients who were treated with Benadryl for other disorders noted improvement in their hay fever.

Side Effects

The majority of the patients developed some degree of drowsiness but in only six was this sufficiently severe to cause the patient to complain. In only one case did it require that the drug be stopped. An effort was made to overcome this effect by administering benzedrine along with the initial dose but it was difficult to judge the amount required and several patients were overstimulated. The hypnotic effect on these patients, however, had greatly diminished after several days of benadryl treatment. In two cases a skin rash was observed which might have been due to Benadryl. Other side effects encountered included: nausea, tremor, dizziness, nervousness, headache, blurring of vision, conjunctivitis, and contractures of the arms and legs. One of the hay fever patients became nauseated upon stopping the Benadryl on two occasions but observed that the nausea disappeared when the drug was begun again. Two other patients also became nauseated upon stopping the drug. This was the only suggestion of withdrawal symptoms encountered.

SUMMARY

A review of 100 cases treated with Benadryl shows that the drug is of most value for acute urticaria including those due to penicillin. It is also of value in chronic urticaria but its alleviating effect is not so marked; larger doses are usually required and in only 1 case was it able to "break the cycle"; in the others it was merely palliative. It is the opinion of the authors that Benadryl shortens the recovery period of poison ivy dermatitis and that in generalized atopic dermatitis subjective improvement occurs often enough to justify the use of the drug.

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ACRYLIC RESIN DENTURE MATERIAL

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Synthetic resinous materials prepared from acrylic acid or any of its derivatives are called acrylics. They may be synthesized from acetone and are obtained in the monomeric or liquid form. The polymer or solid is prepared by polymerization of the liquid.

Polymerization is defined as a chemical change resulting in the formation of a new compound whose molecular weight is a multiple of that of the original substance; a reaction involving a successive addition of a large number of relatively small molecules (monomers) to form the final compound or polymer (1).

The monomer is stable below 149° F., its boiling point is 212.5° F. The liquid monomer may be converted to a transparent solid by polymerization. This process is aided by light, heat, and oxygen, and retarded by the use of reducing agents, such as pyrogallol and hydroquinone (2). An inhibitor is present in the liquid of most denture materials.

There are several methods used to prepare the powder form used in denture work. The most common is known as emulsion polymerization. This is done by polymerization of an aqueous emulsion of the monomer. The monomer is held in suspension by rapid stirring and emulsifying agents such as sodium oleate, starch, or gelatin. A fine granular form results. The size of the granules may be controlled by temperature, the rapidity with which the monomer is added, and the amount of stirring (3).

The size of the polymer particles is important in the control of the color and texture. Large particles will give a granular appearance while smaller ones give a more homogeneous appearance (4).

The coloring matter is made up of insoluble metallic salts and is mechanically mixed with the powdered polymer.

The properties of acrylics can be somewhat modified by the use of plasticizers. Various plasticizers have been employed for this purpose. In some cases they may act as solvents while others may tend to hold the molecules apart so that they may slide over one another more readily. It is believed that these plasticizers add nothing to make the material better for denture use and it has been stated that they detract materially from its properties (5).

Solvents such as acetone and chloroform have been added to acrylics at various times. They do not combine with it chemically. When the resin is polymerized the solvent is trapped and is later eliminated by evaporation (6). They may cause tissue reaction as well as distortion of the denture and loss of strength.

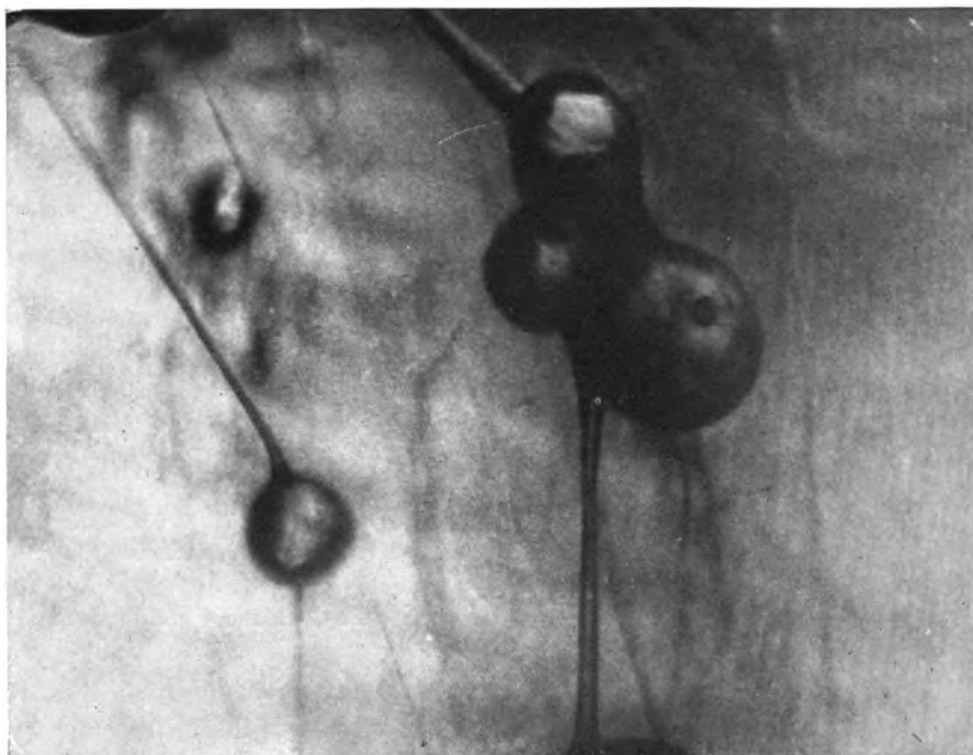


FIGURE 1.—Photomicrograph of denture acrylic mixed and ready to pack. A bubble still remains in one of the granules.

There have been a number of acrylic reline materials placed on the market which are prepared by using a solvent. These materials require 20 to 30 days to harden completely and the material shows a loss of weight in air for as long as 90 days. The materials shrink on hardening and have a tendency to warp toward the lined side (7). Their use should be discouraged because of the free solvent present in the "cured" material and their adverse effects on the base resin of the denture (8).

Methyl methacrylate is cured by polymerization. This is an exothermic reaction giving off about 80 calories of heat per gram of material (9). Uniform chemical properties may be obtained by controlling the polymerization. There are a number of methods of temperature control recommended.

One method is to start heating the water bath at room temperature, gradually raising it to the boiling point. Between the temperatures

of 158° to 168° F. the exothermic reaction takes place and the denture material may reach a temperature of 300° F., this heat of polymerization being proportional to the bulk of material (10). Ninety-five percent of the polymerization takes place during this temperature elevation. Other recommendations range from constant heat at 160° F. for from 3½ to 9 hours and heating for 2½ hours at 160° F. then boiling for an additional hour (11).

During the period of greatest fluidity, 158° F. to 194° F. (12), the skeletal framework of molecules is set up causing an "elastic memory." This structure is permanent and if any attempt is made to change it internal strains will be set up in the material. The Rohm & Haas Co. illustrated this condition in a motion picture "Looking Ahead Through Plexiglas." A cube of Plexiglas was flattened into a disk by the use of heat and pressure. The pressure was then released and heat again applied and the Plexiglas disk returned to its original cubic form.

A number of dimensional changes takes place during the processing of denture acrylics. When the flask is heated the first change is that of thermal expansion. To prevent distortion of the mold during this expansion the flask should be held with a spring clamp which allows it to open slightly. There is then a contraction. This takes place with polymerization and is due to an increase in specific gravity from the monomer (0.945) to the polymer (1.19) (13). This causes a shrinkage in the denture of about 0.5 percent. There is then an expansion of from 0.3 to 0.4 percent when the finished denture is placed in water for several days (14).

The surface of a finished denture, especially where it has been necessary to use a large bulk of material, may occasionally appear porous. This may be caused by a number of conditions. First, by insufficient pressure on the flask during curing. Second, by too rapid curing causing the monomer to volatilize and leave small spaces in the denture base. There is also a condition known as pin point porosity which is caused by small spaces that are already in the granules of the powder. This type of porosity shows up after the denture has been polished and may be prevented by allowing the flask to remain for an hour after packing and before curing. This will allow the liquid to soften the powder and the spaces will be removed by the pressure on the flask (15).

Due to the fact that acrylics are affected by direct contact with plaster it is necessary to use a separator or protecting media. Tin foil is the best material for this purpose. However, there are a number of substitutes which give more or less satisfactory results. There seem to be two types of these materials: one a varnish and the other water soluble (sodium silicate or alginate).

The use of these substitutes in conjunction with tin foil is reported to cause warpage, however, if they are used without tin foil the results may be satisfactory (16).

The Brinell hardness of an acrylic denture resin is variously reported to be between 20 and 30, this is somewhere near that of 24-karat gold (17). It is one of the most scratch-resisting of all resins. The density of the polymer is 1.18 grams per cc. which makes it one of the lightest synthetic resins known and about one-half as heavy as vulcanite.

The material is soluble in ketones and aromatic hydrocarbons. Acrylic resins are both tasteless and odorless. They possess a property to resist surface wetting and appear and feel clean. Bacterial growths do not seem to accumulate or multiply on this material.

The tissue reaction to methyl methacrylate seems to be less common than to vulcanite. It is suggested that this reaction when it occurs may be caused by unpolymerized liquid (18), or from residue chloroform or acetone that may have been employed during processing.

Acrylic resin is a very satisfactory denture material but it must be handled carefully. Due to the comparative simplicity of the technique involved there is a tendency to become careless. However, if the properties of the material are given due consideration and care is exercised in the techniques employed there should be little difficulty in obtaining satisfactory results.

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INCIDENCE OF PALPABLE LYMPH NODES

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During the course of routine physical examinations of naval personnel in an aviation examining room, it was observed that palpable lymph nodes were commonly found in the cervical, axillary, and inguinal regions. Casual reading in medical literature revealed that lymph nodes were frequently described as enlarged or palpable without description of size, consistency, tenderness, or mobility.

In an effort to determine which examinees were to be considered as having enlarged nodes, textbooks of physical diagnosis were consulted. Among six textbooks of physical diagnosis (1) (2) (3) (4) (5) (6) published in the past 10 years, little light was thrown on the subject except in one (6, p. 110) in which it is stated, "The lymphatic glands of the neck are not palpable under normal conditions." In a standard anatomy text (7) it is mentioned that the various lymph nodes are normally palpable and that the nodules vary in size from "a pinhead to an almond."

To satisfy the examiner's curiosity as to the incidence of palpable lymph nodes in normal individuals, one hundred subjects were examined carefully for palpable nodes. The examinees ranged in age from 18 to 41 years, and 90 percent of them were from 18 to 27 years old. All of them were Caucasian males who gave no history of recent illness, prolonged febrile illnesses in the past, nor of syphilis. All apparently were in good health and were accepted as physically qualified for naval service.

The anterior and posterior cervical chains, the axillary and supra-trochlear regions, and the proximal and distal superficial inguinal groups were palpated. The submaxillary and parotid nodes were not tabulated because of the ease with which the salivary glands are confused with the lymph nodes in these areas. The findings were roughly classified into three groups; nodes which were not palpable; nodes which were palpable, but which seemed to be less than 1 cm. in diameter; and nodes which were felt to be from 1 to 2 cm. in diameter. No lymph nodes were encountered in this series which seemed to be greater than 2 cm. in diameter. No attempt was made to record the number

*Resigned.

of nodes in each group which were palpable, although most were multiple except for the supratrochlear nodes, which in each case were solitary and unilateral. In each member of the series, the nodes were nontender, discrete, and freely movable. Only two individuals had no palpable nodes. The findings are tabulated in table 1.

TABLE 1

	Nodes of less than 1 cm.	Nodes from 1 to 2 cm.	Total
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Anterior cervical.....	21	None	21
Posterior cervical.....	19	None	19
Axillary.....	53	23	76
Supratrochlear.....	11	None	11
Proximal superficial inguinal.....	76	8	84
Distal superficial inguinal.....	58	14	72

As Craver (8) points out, the fact that "nodes are palpable by no means necessarily signifies that there is anything wrong with the patient." He states further, however, that there is a "wide borderline field" in which it is most difficult to distinguish between the normal and abnormal lymph nodes. Martin and Morfit (9) confirm this opinion: i. e., that lymph nodes to be palpable are not necessarily "enlarged." They do not regard cervical nodes up to 2 cm. in diameter to be abnormal. Doster (10) doubts that palpable nodes up to 1 cm. in diameter are normal, but believes that they are due to a previous infection, either primary or secondary.

SUMMARY AND CONCLUSION

1. Considerable confusion exists in the literature concerning the significance of palpable nodes, and when lymph nodes are to be considered enlarged.
2. One hundred apparently healthy young men were examined to determine the incidence of palpable lymph nodes in normal individuals.
3. Lymph nodes from 1 to 2 cm. in diameter are palpable in a large percentage of healthy males, and in the absence of other findings, have no significance when discrete, nontender, and freely movable.

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INTRADERMAL TESTS WITH DIROFILARIA IMMITIS EXTRACT IN HUMAN FILARIASIS

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During the Pacific campaign thousands of men in the armed forces were exposed to filariasis, especially those stationed in the Samoa and Wallis areas. Many of them contracted the disease.

Due to the relatively short period of exposure, the causative organism, microfilaria of *Wuchereria bancrofti*, is rarely demonstrable in the circulating blood of the returned serviceman. The diagnosis must therefore depend on a history of exposure and clinical signs and symptoms.

Filariasis may cause enlargement of the lymph glands, especially of the axillary, epitrochlear, postcervical and inguinal regions, lymphangitis of the arms, legs, spermatic cords, and testes, with transient localized swellings. These swellings are painful, and often recur after exercise. As a similar clinical picture may be due to other causes, a specific test for filariasis would be of great value.

In 1930 Taliaferro and Hoffman (1) reported their results of intradermal tests with saline extracts of *Dirofilaria immitis*, the dog "heart worm," in cases of human filariasis. Since then, there have been a number of reports by various investigators. Since there is no uniformity either in the method of preparing the extract, its dilution, the amount injected, or criteria for reading the test, their results vary greatly.

Saunders, Bianco, and Jordan (2) record their results of tests on 389 patients and give a review of the literature. They found that 72 percent of patients with a diagnosis of filariasis gave a positive skin test, 27 percent of those exposed but without clinical symptoms were positive, and 9 percent of patients without known exposure were positive.

During the period July 1944 to August 1945, we tested 200 men at the United States Naval Hospital, Aiea, Oahu, T. H., with a saline extract of dried *D. immitis* worms, prepared by Capt. Bernard Witlin, U. S. P. H. S., director of laboratories, Territory of Hawaii. It was standardized to contain 500 protein units (0.0005 mg. of protein) per cc. of solution. We injected 0.1 cc. intracutaneously in the flexor surface

of the forearm. No control antigen was used. Results were recorded from 1 plus to 4 plus according to the following:

Immediate reaction (15 minutes and 1 hour)

- 1 plus..... Erythema only of at least 1 cm.
- 2 plus..... Erythema of 2 cm. plus a definite wheal.
- 3 plus..... Erythema of 3 cm. plus a definite wheal.
- 4 plus..... Erythema greater than 4 cm., wheal with pseudopods.

Delayed reaction (24 hours)

- 1 plus..... Erythema greater than 1 cm.
- 2 plus..... Erythema greater than 2 cm. with subcutaneous edema.
- 3 plus..... Erythema with marked subcutaneous edema.
- 4 plus..... Erythema greater than 4 cm. with marked subcutaneous edema.

Those which were classed 2 plus or greater, either immediate or delayed reactions, were called positive.

There were 126 patients with a diagnosis of filariasis. Of these, 94 or 75 percent were positive. There were 21 patients who were exposed to filariasis in the Samoa area, but had no symptoms of the disease. Of these, 6 or 29 percent were positive.

We also tested 53 patients who had not been in the Samoa or Wallis areas, and had probably not been exposed to filariasis. Of these, 10 or 19 percent were positive (table 1). Among the positive reactors in the filariasis group, 9 or 7 percent gave positive delayed reactions in the absence of positive immediate reactions, and 21 or 17 percent showed both immediate and delayed reactions, giving a total of 24 percent delayed reactions. In the nonfilariasis group of reactors, 4 or 25 percent gave delayed reactions.

TABLE 1.—*Results of tests with 0.1 cc. Dirofilaria immitis antigen*

Reaction	Patients with diagnosis of filariasis		Patients exposed to filariasis		Patients without known exposure	
	Number	Percent	Number	Percent	Number	Percent
Immediate positive delayed negative.....	64	51	4	19	8	15
Immediate negative delayed positive.....	9	7	2	10	1	2
Immediate and delayed positive.....	21	17	0	0	1	2
Total positive.....	94	75	6	29	10	19
Total negative.....	32	25	15	71	43	81
Total.....	126	100	21	100	53	100

For the immediate reaction, the tests were read at the end of 15 minutes, and also at the end of 1 hour. In the filariasis group, 13 tests which were negative at the end of 15 minutes, were positive at the end of 1 hour. Since 9 of these were also negative at the end of 24 hours, they would have been missed if no reading were taken at 1 hour.

Saunders et al. (2) report that of their filariasis patients who were stationed in Samoa, 81 percent reacted positively to the filaria skin test, while of those who had not been in Samoa, only 45 percent reacted positively. This was not true in our series, as the percentages were nearly the same in both groups. However among the group not diagnosed filariasis, 29 percent of those exposed in Samoa gave positive skin tests compared to 19 percent not exposed there (table 2).

Skin tests were performed on five patients with schistosomiasis japonicum, and three were found positive. Four patients with hookworm, and one each of ascaris, *E. histolytica* and strongeloides were also negative.

TABLE 2.—Results of skin tests with relation to known exposure in Samoa area

Patient group	Exposure in Samoa		No exposure in Samoa	
	Number of cases	Percent positive	Number of cases	Percent positive
Filariasis.....	94	75	32	78
Exposed only.....	21	29	53	19

SUMMARY

1. Intradermal skin tests with a saline extract of *D. immitis* were performed on 200 patients at the United States Naval Hospital, Aiea, Oahu, T. H.

2. Of 126 patients with a diagnosis of filariasis, 94 or 75 percent were positive.

3. Of 21 patients who had lived in Samoa but had no evidence of filariasis, 6 or 29 percent were positive.

4. Of 53 control patients, 10 or 19 percent were positive.

5. Of 64 immediate reactors, 13 were negative at the end of 15 minutes, but positive at the end of 1 hour.

6. Of five patients with schistosomiasis, three were positive.

CONCLUSION

Intradermal tests with a saline extract of *D. immitis* is of some value as an aid in the diagnosis of filariasis. However, it cannot be depended upon exclusively, as it was negative in 25 percent of our suspected cases, and positive in 19 percent of a control group.

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A STATISTICAL REVIEW OF 1,000 ORTHOPEDIC CONSULTATIONS AT A NAVAL DISPENSARY

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A series of 1,000 consecutive cases appearing for orthopedic consultation at the outpatient department of a dispensary at a naval air station, is presented in order to point out the commoner lesions which one might expect to encounter at such an activity, and to analyze critically several of the more interesting categories. After careful study of each case, including x-ray and laboratory examinations whenever indicated, the general classification shown in table 1 was adopted.

TABLE 1

<i>Cases</i>	<i>Number</i>	<i>Percent</i>
Arthritis.....	54	5.4
Bursitis.....	17	1.7
Internal derangement, knee.....	94	9.4
Dislocation.....	14	1.4
Pes planus.....	128	12.8
Fracture.....	108	10.8
No organic lesion.....	170	17.0
Scoliosis.....	11	1.1
Low back sprain.....	105	10.5
Foot strain.....	113	11.3
Other causes, low back pain.....	36	3.6
Contusion.....	32	3.2
Ankle sprain.....	19	1.9
Other causes, foot disability.....	18	1.8
Miscellaneous.....	81	8.1
Total.....	1,000	100.0

Among the miscellaneous conditions were traumatic amputations of fingers, ankylosis, ganglion, tenosynovitis, and others, including 2 cases of proved, frank malingering, and 22 cases of muscular weakness from poor development or disuse.

Of the 17 percent of patients who were proved to have no organic basis for their complaints, an analysis of the areas complained of, showed the following:

TABLE 2

<i>Anatomic area</i>	<i>Number</i>	<i>Percent</i>
Knee.....	51	30.0
Back.....	47	27.6
Shoulder.....	17	10.0
Leg.....	12	7.1
Feet.....	9	5.2
Hip.....	8	4.7
Other areas.....	36	15.4

The unclassified areas included elbow, wrist, neck, and hand.

All of the cases listed as *pes planus*, were either pronation or calcaneovalgus, or actual flattening of the longitudinal arch. Those listed as foot strain included 51 of longitudinal arch strain, and 52 cases of metatarsalgia, which were either strain or depression of the anterior arch. Those listed as other causes of foot disability included apophysitis of the calcaneus, hallux valgus, hammer toe and talipes equinovarus.

The 105 cases of low back sprain included 41 of the lumbosacral joint, 19 sacro-iliac, 43 postural, and 2 affecting the sacrospinalis muscles. Among the other causes of low back pain were differences in length of the lower extremities, spondylolisthesis, contractures of the tensor fascia femoris and herniations of intervertebral disks.

The most common fracture involved the carpal navicular (24), followed by the malleoli at the ankle (16), and the phalanges (10), and spine. Others involved metacarpals, metatarsals, tibiae, and distal end of the radius, in that order.

Rupture of the internal semilunar cartilage was the commonest (45) of the 94 cases of internal derangement of the knee. Four cases of external cartilage injury were observed, and 4 of cyst of the external semilunar. All of these were confirmed by subsequent operation. There were 9 cases each of rupture of the tibial and fibular collateral ligaments, and 4 of the anterior cruciate. Others included 13 cases of osteochondromatosis, 4 of osteochondritis dissecans, and 2 of hypertrophy of the infrapatellar fat pad.

Forty of the fifty-four cases of arthritis were listed as chronic arthritis. In each of these there was an elevated sedimentation rate and either x-ray or observable soft tissue change, and frequently a history or the actual presence, of focal infection. The remaining cases included six of trophostatic osteoarthritis, the low incidence of which is presumed due to the average younger age group of the patients in this series, and four of traumatic arthritis.

No detailed analysis of the remaining specific categories seems indicated except to comment that the most common bursitis involved the subacromial bursa, while the most common dislocation was that of the shoulder (50 percent), and the commonest ankle sprain involved the calcaneofibular ligament.

A statistical review of 1,000 orthopedic consultations has been presented showing the relative incidence of conditions seen at an average naval dispensary. The classification and subclassifications seem to fit the circumstances satisfactorily, and it is suggested that similar records be kept in order to make subsequent reviews of specific conditions more readily available.



PSYCHIATRIC DATA COMPILED AT A UNITED STATES NAVAL PERSONNEL SEPARATION CENTER

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There have been a number of comprehensive reports on the evidence of neuropsychiatric disorders at induction and recruiting stations. The types of defects, both physical and emotional, have been evaluated in adequate numbers of selectees for both this country and that of Great Britain.

It is generally agreed that between 40 and 50 percent of inductees are rejected for various reasons and from 15 to 20 percent for neuropsychiatric disorders or personality defects, often mild and masked enough not to be a problem in civilian life.

In spite of this screening some 20 percent of battle casualties and 30 to 40 percent of medical discharges carry neuropsychiatric diagnoses.

It is therefore of importance to see if, in the final discharge examination of the naval enlisted man from an actual duty status, there is any appreciable incidence of neuropsychiatric complaints or disabilities. It is to be noted here that this material does not represent any hospitalized patients but does include any that may have been some time on a neuropsychiatric service, who recovered sufficiently to be sent back to duty, which in some cases, was limited to the territorial United States.

The separation center processed from 600 to 1,400 subjects daily and some 40,000 had passed through at the time of the compilation of this report.

The data described does not include anything like the whole number but is limited to unselected samples and groups and includes a total of 7,823 subjects.

There are essentially two parts to the material described. The first part was a study of the completed physical examination papers from which the following was obtained:

- (1) Intention of filing disability pension claim.

(2) Evidence of neuropsychiatric complaints and diagnosis in the health record or in the period of actual military duty.

(3) Evidence of visual defects alone where no other defect is found, both corrected and uncorrected by lenses.

(4) Evidence of orthopedic, genito-urinary, or other physical defects not requiring hospitalization.

(5) The evidence of the presence of pilonidal cysts.

(6) The percentage of separatees with no physical or psychiatric defect.

(7) The evidence of insignificant, minor defects not a problem to the subject such as fine tremors, deviated septums in the nose, acne of the body, moderate tonsillar enlargement, hemorrhoidal tabs, and mild degrees of flat feet.

(8) The presence of a resting pulse of over 100 which remained above 100 three minutes after exercise.

The second part of the investigation involved the psychiatric examination of groups of these men.

The first group were those who told the medical officers, not psychiatrists, that they had in their records a neuropsychiatric diagnosis or had had while in the service psychiatric or emotional problems. The subjects all had their records checked by hospital corpsmen for such diagnosis as an additional measure.

All such subjects were referred to the psychiatrist who appraised the nature and severity of their symptoms and determined whether hospitalization was necessary.

The low percentage of such subjects, i. e., 2.4 percent led us to believe many men were withholding histories of neuropsychiatric trouble for fear admission would delay or prevent separation from the service.

Since 7 percent of the total group were running resting pulse rates over 100 for no apparent reason, it seemed a good idea to explore these tachycardias. Accordingly, any subject with a resting pulse of over 100 was referred to the psychiatrist. It was pointed out in the resulting interview that this was a survey or experimental study in no way set up to delay or alter separation.

It was found that 40 percent of such tachycardias had mild psychoneurotic histories and 4 percent histories of moderate psychoneurotic symptoms. To control this, 100 men with no increase in pulse rate and no obvious neuropsychiatric story were interviewed by the psychiatrist. In this control series, 10 percent gave histories of mild neurotic symptoms and none of moderate or severe. This agrees with other such control series.

The summary of the collected data is shown in table 1.

TABLE 1.—*Summary of data found from examination of 7,823 individual records*

	Number found	Percent
Intention of filing pension claim.....	266	3.4
Ordinary incidence of neuropsychiatric history in record.....	186	2.4
Visual defect corrected.....	464	5.9
Visual defect uncorrected.....	1,072	13.8
Other physical defects.....	2,023	25.6
Pilonidal cyst.....	125	1.6
Minor disability.....	815	10.4
Tachycardia (resting pulse 100).....	547	7.0
No defect.....	3,997	51.2

DISCUSSION

The type of psychiatric interview which lasted about 10 minutes, covered questions about childhood and pre-enlistment neurotic symptoms such as bedwetting, sleepwalking, nail biting, unreasonable fears of dark, noise, confined spaces, shyness, spells of anxiety, difficulties in adjustment in school—homework—sex or other social contacts, and histories of chronic somatic vulnerability in the gastrointestinal tract or cardio respiratory system as well as headaches, dizzy or faint spells, etc. The subject was also asked about his service history—length of time overseas and ability to tolerate the stresses of fatigue, combat, and domestic separation. Data as to length of service, time overseas, and combat experience is shown in table 2.

TABLE 2

	Overseas under 18 months		Overseas over 18 months	
	Tachycardia	Normal pulse	Tachycardia	Normal pulse
Combat experience, no N. P. findings.....	3	16	28	25
Combat experience, N. P. findings.....	5	1	10	2
No combat experience, no N. P. findings.....	8	11	8	19
No combat experience, N. P. findings.....	11	3	12	1

It is to be noted that the average subject interviewed here, whether he had a mild history of neurotic symptoms or not, successfully adjusted to the demands of military naval service in wartime. The small percentage of those with moderate neurotic histories also fitted into their military environments without hospitalization but did have difficulty in so doing and might have done better in a civilian war project.

The point to be emphasized is that about 15 percent of the armed forces do their combat and other duties efficiently and successfully in spite of definite neurotic symptoms in their past lives. From other

studies it is known that the serious long standing combat and operational psychiatric casualties come from men with such histories and exclusion of all such men might therefore reduce significantly the incidence of poor psychotherapeutic results.

The problem of mild neurotic histories being unmasked by the presence of resting pulse rates of over 100 confirms the thesis that unstable personalities correlate with unstable physiology. Excluding those that overindulge prior to the examination or who had mild infections (colds) the figure of 44 percent shows that this group is worth keeping an eye on by the psychiatrist when men are discharged or inducted.

COMPARISON OF TACHYCARDIA SUBJECTS WITH CONTROL SUBJECTS AS TO LENGTH OF OVERSEAS SERVICE

It is noted that the tachycardias with positive neuropsychiatric findings are 59 percent of the group that were overseas less than 18 months whereas they represent only 38 percent of the group out over 18 months.

There was no essential difference in the men examined with normal pulse rates in this respect.

Of the tachycardias with neurotic histories, 31 percent had pulses over 90 on induction and over half of these, or 18 percent, of the group had entrance resting pulses of over 100. Of the tachycardias not giving neurotic histories, 19 percent had entrance resting pulses over 90 and only one-tenth of those over 90 or 1.7 percent of the whole pulses over 100. This would indicate that a recurring tachycardia is good reason to suspect a neurosis.

An example of tachycardia with a neurosis picked up by interview because of the presence of the tachycardia is as follows:

A 36-year-old divorced machinist's mate, first class on separation after 2½ years of service, of which 2 years were overseas in a noncombat area, was referred because of a resting pulse of 112 which after exercise remained at 116. On entry, pulse was 96. Past history showed presence of persistent nail biting, enuresis to 14, difficulty with sleeping, a delicate stomach, shyness at school, subject to excessive worry and overconcern about health with cancerphobia. Marriage was stormy and sexually unsatisfactory ending in divorce. Overseas he worried and complained a good deal yet he never turned in and his health record is free of entries of this trouble or hospitalization of any sort. He apparently did his job well in spite of his problems.

An example of a tachycardia with no neurotic history follows:

A 21-year-old single gunner with a resting pulse on separation of 124 was seen because of this pulse. After exercise it remained at 110. On entry 5 years before it was 62. He had been overseas 2 years on a ship in combat most of the time. There was no history of neurotic traits or illness and all adjustments were healthy and normal.

The percentage of 51.2 for separatees with no defects seems low for a body of men previously on active duty—but if the 10.4 percent for minor disabilities and the 5.9 for corrected vision be included, the percentage is around 66 percent which is what one might expect.

SUMMARY

The examination forms of 7,823 separatees showed an incidence of psychoneurosis as obtained in routine way of only 2.4 percent.

Seven percent of the men had resting pulses over 100. Of these, nearly half, or 44 percent, or an additional 3 percent of the whole group, gave histories of definite neurotic traits or complaints not sufficient to put them on sick list or interfere with naval service. In a control group of 100 men with no record or physiological evidence of any instability, 10 percent admitted very mild neurotic symptoms that were not serious enough to bother them in the service. There are therefore three groups of separatees with some neuropsychiatric problems: (*a*) 2 percent who have had frank episodes that brought them to the sick list with entries in the record, (*b*) 3 percent who by a fast pulse show an underlying sensitivity but who kept at work and out of the medical department records, (*c*) 10 percent with history of milder symptoms that show up only in a psychiatric interview—a total of 15 percent that should be kept in mind psychiatrically for the future.

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LABORATORY EXAMINATIONS FOR TUBERCULOSIS

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This is an article giving the laboratory methods for examining specimens for tubercle bacilli used at United States Naval Hospital, Sampson, N. Y. Laboratory technicians in other hospitals may find it interesting and helpful to know how a large institution does satisfactory work with a minimum of personnel and material.

SPUTUM

Concentration for smears.—Sputum is collected in glass jars; a 1.0 percent solution of sodium hypochlorite equal to the amount of sputum is added to each jar. The mixture is shaken a little and allowed to stand 15 minutes. At the end of that the jar is shaken well and about 15 cc. of the mixture is poured into a centrifuge tube. The specimen is then centrifugalized 7 minutes at 2,000 revolutions per minute. The supernatant is poured off and the sediment is poured on a slide. If there is very little sediment, and there is still some of the mixture in the specimen jar, it may be poured into the centrifuge tube on top of the sediment and centrifugalized again. The smear is air-dried or dried over gentle heat, fixed, and stained with carbolfuchsin over heat. The stain should steam 5 to 10 minutes. For destaining 95 percent ethyl alcohol with the addition of hydrochloric acid to 3 percent is used. The counterstain is Löffler's methylene blue or 0.15 percent aqueous malachite green.

The bleach used in this laboratory is obtained from the laundry and is diluted 1 in 5. The laundry uses it 1 in 10. Sodium hypochlorite, 3.0 percent solution, may be used undiluted but it is cheaper to dilute it 1 in 3, as a 1 percent solution is all that is necessary. Most commercial bleaches are 3 percent sodium hypochlorite solutions. Sputum concentrated in this manner cannot be used for cultures as the bleach kills the tubercle bacilli.

Concentration for cultures.—The sputum is collected in glass jars and an equal amount of sterile 1 percent solution of sodium hydroxide is added. The mixture is shaken by hand until it is well digested. With a mechanical shaker the mixture should be shaken 7 minutes at a rate of 240 vibrations per minute and a displacement of 3 inches. The mixture is now poured into a 25 by 150 mm. sterile test tube,

corked, and centrifugalized 7 minutes at 2,000 revolutions per minute. The supernatant is poured off except for 3 or 4 cc. One drop of bromthymol blue or bromcresol purple is added with a 1 cc. pipette. Two and one-half percent solution of oxalic acid is added until the mixture is slightly acid. If a measured amount of 1 percent sodium hydroxide solution is used, an equal amount of 2½ percent oxalic acid solution may be used without reference to a color indicator. If the specimen is small an equal amount of oxalic acid may be added immediately after digestion without first centrifugalizing. After the addition of oxalic acid the specimen is shaken to insure thorough mixing, and is then centrifugalized 7 minutes at 2,000 revolutions per minute. The supernatant is poured off so that the sediment is nearly dry. It should be the consistency of thick cream.

The sediment obtained from the sodium hydroxide-oxalic acid concentration is now slightly acid, this serving the purpose of killing or inhibiting the growth of non-acid-fast bacteria. Also, tubercle bacilli grow better on an acid medium. Place 2 drops (0.1 cc.) of the sediment on a Petragnani slant with a 1 cc. sterile pipette, and 1 drop on a slide for a smear. When inoculating the slant and making the smear spread the material a little with the tip of the pipette as you go along. If the laboratory can afford it, two slants should be inoculated. The culture tube is corked. The label on the tube bears the patient's name, ward, type of specimen, date, and culture number. In this laboratory the cultures of each day are held together by a rubber band over a sheet of paper bearing the date and the number of specimens. Incubate the cultures at 37.5° C. and examine at 1 month and 2 months. Care should be taken not to pack an incubator so full that the air does not circulate freely.

Growth of the tubercle bacilli appears as discrete, pale yellow, raised, dry colonies with finely wrinkled or convoluted surfaces. The colonies are often shaped like a doughnut with a hole in the center. On removal with a platinum-iridium spade, the firm colonies slide off the surface of the medium intact. With pressure the colony crumbles on the slide and in making the smear one gets the feeling of stiff grease or wax. PLEASE NOTE: Colonies of true tubercle bacilli are definitely not smeary. (Compare with acid-fast saprophytes which are smooth, glossy, soft, and smeary; are frequently orange but may be cream colored.) When grossly typical colonies show acid-fast bacilli microscopically tubercle bacillus is reported. Doubtful colonies are inoculated on another slant and incubated at room temperature. Two slants may be inoculated and one placed in the incubator. Saprophytic acid-fast bacilli grow up in from 4 to 7 days at room temperature. Tubercle bacilli do not grow at room temperature. This is an inexpensive way of differentiating between the two. Guinea pigs may be used, but the

saprophytic acid-fast bacilli may remain in the tissues and even proliferate a little so that they may be found at autopsy. They will also cause a guinea pig to give a positive skin test. So it is sometimes necessary to culture the organism again after passage through a guinea pig.

If the culture slants are not dried before inoculation, or if the slants have not been heated until they are quite firm in consistency, the tubercle bacilli will grow in a smooth manner. As this makes the reading of the cultures confusing it is important to have the culture medium properly dried and inspissated.

In making verification smears from colonies on a solid medium one should place a loopful of 25 percent dilution of serum and water on the slide and emulsify the colony in that. This will help retain the organisms on the slide while it is being dried and stained. The loop should be dipped into boiling water before it is flamed to keep the organisms from sputtering and flying out into the room. Tubercle are waxy and sputter in the flame like anything else that is greasy. The organisms that are in the center of particles thrown off by a flame are not always dead. As these organisms are not readily killed by drying it is dangerous to contaminate your surroundings with them.

GASTRIC CONTENTS

A fastening specimen is collected in 25 by 150 mm. sterile, corked test tubes. If there is a good deal of water, the specimen may be centrifugalized before sodium hydroxide is added. Gastrics are treated in the same way as sputa. In this laboratory smears and cultures are done routinely on gastrics.

PLEURAL FLUIDS AND PUS

Pleural fluids and pus suspected of having tubercle bacilli often have pyogenic organisms and a search should be made for them before culturing the material for tubercle bacilli. As a rule, clear fluids are free from pyogens. They should be centrifugalized and smears made of the sediment for Gram and acid-fast stains and a blood plate streaked. The sediment is then treated with sodium hydroxide and oxalic acid as for sputum. As there is often a small fibrin clot which is impossible to digest, it is a good idea to pour serum broth on this and incubate it after a Petraghani slant has been inoculated. Very often tubercle bacilli are sticking in the fibrin clot and it is occasionally possible to get growth in the serum broth when none occurs on the slant.

Thick fluids with many polymorphonuclear leukocytes are not centrifugalized. As they very often have pyogens one should streak a blood plate and make a Gram stained smear before treating the material for tubercle bacilli. It is not necessary to concentrate more than

2 cc. of purulent material unless several specimens taken at the same time show a variation in gross appearance. As these purulent fluids are often somewhat rubbery in consistency it may be necessary to use more than an equal amount of 1 percent sodium hydroxide solution and vigorous shaking to break them up. Add as much 2½ percent solution of oxalic as of 1 percent sodium hydroxide solution and again shake the mixture vigorously. Sometimes better results are obtained if the sediment after centrifugalization is digested a second time. A duplicate slant may be inoculated with untreated pleural fluid or pus, but growth does not occur as often as it does with digested material. Moreover, if there are staphylococci present, they will overgrow the slant.

Bronchoscopies are centrifugalized, streaked on blood agar, and smears made for Gram and acid-fast stains. The remainder of the sediment is treated with sodium hydroxide and oxalic acid the same as sputa. Petragnani slants are inoculated. All of the pyogenic organisms are identified. They present an interesting variety. Often some, even those normally considered nonpathogenic, cause the patient more irritation than his tuberculosis.

Swabs on the whole are not suitable for the examination of tubercle bacilli, either for smear or culture. Wherever possible a syringe should be used to aspirate pus. However, if a swab is received in the laboratory with a request for acid-fast examination, this procedure may be followed if there is enough material on the swab. Swabs that have a few visible signs of pus are not worth fooling with, but if there is considerable pus, blood, mucus, and possibly bits of tissue one is often able to get positive smears and cultures from them. First make a smear on a new clean slide that has just been flamed. Be sure to save at least half of your material for the culture. Pour enough 1 percent sodium hydroxide solution on the swab to just cover it. Let it stand 5 or 10 minutes to loosen up the material. Shake or tap the tube until the swab is fairly clean. Squeeze the swab dry and discard it. To the suspension in the tube add an equal amount of 2½ percent solution of oxalic acid, mix by shaking, centrifugalize, discard the supernatant, and plant the sediment on a Petragnani slant.

Sometimes biopsies are brought to the laboratory to be examined for tubercle bacilli. These may range from several large lymph nodes to tiny shreds of tissue sticking to a piece of gauze. If the specimen is large it is ground in a sterile mortar with sterile ground glass or alundum. It is wise to cut lymph nodes and other large specimens into rather small pieces with a sterile scissors. A small amount of sterile physiological salt solution should be put into the mortar to keep pieces of glass from flying out in every direction.

When the tissue has been ground to a paste add enough sterile physiological salt solution to suspend the particles and pour the mixture

or pipette it with a 10 cc. pipette into a sterile test tube. Add an equal amount of 1 percent sodium hydroxide solution and shake the mixture for several minutes. Add enough 2½ percent solution of oxalic acid to acidify it slightly and centrifugalize. Inoculate several Petraghani slants and make one or two smears. Good smears can be made with the scissors when the tissue is being cut up preparatory to grinding. Macerate little shreds of tissue on a slide with the flat side of the scissors or another slide. Stain in the same manner as you would stain sputum or pus. It is often easier to find acid-fast bacilli on such a smear than in sections and it takes less time to make a smear.

If the tissue is so small that it would be lost in the mortar, make a smear by macerating a small portion of the specimen on a slide. Chop or cut the remainder as fine as possible with a small sterile scissors or scalpel. Put the shreds into a test tube and pour a little 1 percent solution of sodium hydroxide on them. Shake vigorously in order to break up the tissue as much as possible; add an equal amount of oxalic acid (2½ percent solution) and shake the mixture for several minutes. Centrifugalize, pour off the supernatant and plant the sediment on Petraghani slants. If the shreds are too big to be taken up by a pipette, they can be picked up with a sterile loop and placed on the medium.

If guinea pigs are to be inoculated with tissue material, be sure that the material is neutral. Wash the sediment twice in several volumes of sterile physiological salt solution. After the second washing the sediment may be diluted with sterile physiological salt solution so that it can be picked up with a needle and syringe. Material to be picked up with a needle and syringe may be poured into a sterile Petri's dish to facilitate matters and prevent possible spilling and contamination.

SPINAL FLUID

Tuberculous meningitis is not an uncommon complication of pulmonary tuberculosis. It is probably acquired by the hematogenous spread which so often accompanies miliary tuberculosis. At autopsy generalized tuberculosis is usually seen, although there have been cases of tuberculous meningitis in which it was hard to find the primary lesion. The incidence is greatest in infants, young children, and the age group between 15 and 25 years. The incidence in older people is rather small. The mortality is very close to 100 percent. There are about 40 recoveries from authentic tuberculous meningitis listed in the literature. The duration of the illness is from 12 days to 3 months. Because the prognosis in this disease is usually considered negative it behooves a technician to be absolutely sure of his work before he reports acid-fast bacilli in the spinal fluid.

One of the first prerequisites to finding acid-fast bacilli in spinal fluid is a fairly large amount of spinal fluid. At least 10 cc. is desirable. Centrifugalize the fluid at 2,000 revolutions per minute for 30 minutes. Pour off the supernatant and save it for chemistry; make a smear from the sediment. If there is a pellicle, and there almost always is, fish it out and macerate it on one end of a new slide. Be sure to tear the pellicle to fine shreds with your loop; do not try to mount it whole. Even though you should succeed in mounting it whole it would probably stick to the blotter when you dry the smear, and if it did not you would not be able to see through it anyway. While a pellicle is usually present in tuberculous spinal fluid it is not indicative of tuberculous meningitis. Nearly every poliomyelitis spinal fluid has a pellicle, too. When you have mounted the pellicle put 2 or 3 loopfuls of the sediment on the other end of the slide. Usually it is easier to find the organisms in the smear of the pellicle, but it is possible to observe the cell picture more clearly where it is not confused by the pellicle. Stain the smear with carbolfuchsin, steaming it for 5 or 10 minutes. Destain carefully with 3 percent solution of acid alcohol, and counter-stain with alkaline methylene blue. Wash and blot dry with a new filter paper. Use only dropping bottles for the staining procedure and running tap water for washing.

Examine the smear under oil immersion, using the No. 6 oculars, for at least 10 minutes before reporting a negative. The organisms are usually very scarce. It does not pay to keep searching after your eyes become tired because you risk giving a false positive report; but if the smear is a good one it is often worthwhile to examine it again later in the day or on another day. Sometimes organisms have been found on the third try. The search should be methodical, in sections across or the length of the smear, although it is often profitable to follow a shred of pellicle from one end to the other.

The cell picture is important in tuberculous meningitis. Usually lymphocytes predominate. The number of neutrophils will vary from 10 to 75 percent, 25 to 40 percent being the average. It is easier to find organisms on specimens that have 40 percent or more of neutrophils than on those that have only around 10 percent. The total cell count is not extremely high; the typical gross appearance of tuberculous spinal fluid is that of ground glass. A clear spinal fluid is not worth a great deal of trouble in cases suspected of this disease.

The best culture medium for the growth of tubercle bacilli in spinal fluid is serum broth. Pour 5 to 7 cc. of this broth on the sediment remaining after the smear is made, stopper the tube with a cork, and incubate at 37.5° C. Examine the culture daily for 3 days in order to rule out other organisms, especially coccidioides which grows up in 48 hours and gives the same cell picture and low chlorides as the tubercle

bacillus. Unless there is some reason for it, it is not necessary to examine the culture again for a month or 6 weeks. The culture will show macroscopic growth in 10 days to 2½ months, depending on the number of organisms present in the specimen. To examine the cultures is easy. The supernatant is clear; give the tube a smart tap or a short jerk. If there is growth, the cream colored compact colonies will come up in a swirl and sink down immediately. If the colonies break up and the broth becomes turbid, you have a contaminant. The culture should be verified by smear. It is easiest to make the smears with a pipette, but if there is a heavy growth it can be fished out with a stout loop. On smear the organisms look just as they do on a solid medium. They appear to grow in the form of a rope which is piled up in numerous loops. If the diagnosis has not been verified by autopsy by this time, it is best to verify your culture further by guinea pig inoculation.

With serum broth it is possible to get almost 100 percent positive cultures. Failure to get a positive culture is almost always due to contamination with faster growing organisms, usually diphtheroid bacilli or staphylococci. Unfortunately, positive cultures are of little clinical value because the patient almost always dies before the culture shows a growth. If macroscopic growth appears before the patient dies it is because there are so many organisms present that they can be found on direct smear. The same holds true for guinea pig inoculation. Positive cultures have their greatest value in completing records in which an autopsy could not be obtained, or where there has been disagreement in autopsy findings. Two instances come to mind. One case was an infant signed out as bronchial pneumonia; and an adult signed out as syphilitic meningitis.

Although chloride determinations are not in the realm of bacteriology, it is believed a few remarks on the chlorides in spinal fluid from possible cases of tuberculous meningitis are not entirely out of place at this point.

One cannot as a rule say on a single determination of spinal fluid chlorides that a case is or is not tuberculous meningitis. However, if spinal fluid is taken several times during the course of the illness, the curve of tuberculous meningitis always goes downward. It may be a little jagged, may drop suddenly from normal to very low and straightened out, and it may have a sudden rise to normal or almost normal a day or two before death, but in almost 100 percent of the cases the chlorides will be below normal. In 125 cases of tuberculous meningitis seen at Los Angeles County General Hospital there was only one whose spinal fluid chlorides did not drop below the lowest normal figure of 650 milligrams percent. One may safely conclude then that a meningitis case whose chloride curve has a downward trend has tuberculous meningitis.

It is true that one can get low spinal chlorides sometimes with other types of meningitis, but if one follows the curve one will find that as the patient begins to recover the chloride curve moves upward. Cloudy spinal fluids containing many polymorphonuclear leukocytes always have low chlorides. Encephalitis and choriolymphocytic meningitis also often show low spinal chlorides on the first few specimens. However, as the cell count drops, the chlorides rise until the figure is normal.

There are several methods of determining chlorides in spinal fluid, but the most delicate one in my estimation is Seelman's method. The normal range with this method is 650 to 800 milligrams percent. With this method tuberculous meningitis will sometimes show spinal chlorides as low as 480 milligrams percent, while 530 to 600 milligrams percent is a common figure for these cases.

FECES

Ordinarily the finding of acid-fast bacilli in feces has no significance. Where sputum is not raised gastric washings are usually resorted to. Only in cases of enteritis where there are no discernible pulmonary lesions is the finding of acid-fast bacilli in the feces of interest. The method for this examination is given herewith.

1. Emulsify a small amount of feces in about 5 cc. of physiological salt solution.
2. Centrifugalize 2 or 3 minutes at 1,200 revolutions per minute.
3. Decant supernatant fluid into a sterile test tube and centrifugalize for 10 minutes at 2,000 revolutions per minute.
4. Discard supernatant fluid, add physiological salt solution to the sediment, shake, and centrifugalize 10 minutes at 2,000 revolutions per minute.
5. Decant supernatant fluid and make smear from sediment.
6. Stain the same as sputum and examine for acid-fast bacilli.

URINE

A 24-hour specimen of urine is collected in as sterile a manner as possible in a sterile gallon jug. Gallon vinegar jugs from the galley are acceptable here after they have been cleaned and sterilized.

After collection the specimen is set at a slant in a pan or wire basket and allowed to sediment 24 hours. The supernatant is decanted carefully and the sediment, of which there is usually about 200 cc., is placed in sterile 25 by 150 mm. sterile corked test tubes and centrifugalized for 10 minutes at 2,000 revolutions per minute. Half of the sediment is then treated with 1 percent solution of sodium hydroxide and 2½ percent solution of oxalic acid in the same manner as sputum. The remaining sediment is treated with a solution of phemerol. The concentrates in both instances are inoculated on Petraghani slants.

As the phemerol method is still in an experimental stage, it is not given here. It has given very promising results, however, on urine,

feces, and pus; and as soon as enough cases are collected to make a definite statement, the method will be added to those already in regular use.

Catheterized specimens from the kidneys usually are free from contaminants and can be inoculated into a guinea pig, but for cultures it is better to treat the sediment with sodium hydroxide and oxalic acid. If a contaminant is present it is usually *Escherichia coli* which grows profusely on Petraghani slants. When working with these specimens it is highly important that the labeling of smears and cultures be absolutely accurate. Reporting a positive on the wrong kidney may cost a patient his life.

ANIMAL INOCULATION

Sputum is shaken with an equal quantity of 1 percent sodium hydroxide solution. The mixture is centrifugalized 10 minutes at about 2,000 revolutions per minute and the supernatant discarded. The remaining sediment is washed by mixing it with sterile physiological salt solution, recentrifugalizing and again discarding the supernatant.

(NOTE: Treatment with sodium hydroxide only sufficiently inhibits secondary micro-organisms that they do not interfere with the development of tuberculosis in the guinea pig.)

This sediment is broken up and drawn up in a syringe fitted with an 18–20 gage needle. A guinea pig is inoculated subcutaneously in the right or left flank near the inguinal region and intraperitoneally.

Guinea pigs are examined at 1 month after inoculation. If clinical disease is present they are autopsied at this time. If not, they are allowed to go a full 2 months before autopsy. Clinical disease manifests itself by the development of enlarged firm lymph nodes on the side of the inoculation (large soft inguinal nodes are likely to be due to a nontuberculous infection.) There may also be a mass and/or an ulcer at the site of inoculation while the animal may have lost weight and muscle tone.

For autopsy, the guinea pig is etherized (in a gallon can with the cover pressed tight). Alcohol 70 percent is poured over the ventral surface. The skin is reflected with sterile scissors and forceps, the inguinal lymph nodes exposed, opened, and a smear made from any pus or caseous material found. The abdominal and chest cavities are opened with a second set of sterile instruments. Spleen, liver, lungs, and tracheobronchial lymph nodes are examined for tuberculosis. This appears in the spleen as definite raised nodules which are not to be confused with normal malpighian bodies. This organ will also be enlarged which will be an immediate hint for examination for tubercle bacilli. Liver and lungs will show tiny, flat, gray places or larger

areas of yellow caseation. The tracheobronchial lymph nodes will be enlarged and firm almost to the degree of being cartilaginous while caseation may or may not be present.

In case of doubt as to gross disease, microscopic sections are made of the aforementioned organs and lymph nodes. Very good smears can be made by macerating small bits of liver and spleen on a slide with another slide. These may then be stained in the usual manner.

Proof of living, virulent tubercle bacilli requires the presence of visceral tuberculosis and the demonstration of an acid-fast bacillus in pus or caseous material from the inguinal lymph nodes or elsewhere.

CODE FOR ACID-FAST BACILLI

Reading—Direct smear and concentration

- 1+ 1-6 bacilli in 10 minutes
- 2+ 7-20 bacilli in 10 minutes
- 3+ Up to 2 bacilli per field
- 4+ More than 2 per field

Reading—Culture

- 1+ Possible colonies in all tubes at 2 months
- 2+ 1-10 colonies in all tubes at 1 month
- 3+ 11-40 colonies in all tubes
- 4+ 41 or more in all tubes

Reading—Guinea pig inoculation

- 1+ Minimal visceral disease in 2 months
- 2+ Minimal visceral disease in 2 months
- 3+ Moderate visceral disease in 2 months
- 4+ Extensive visceral disease in 2 months

THE CARE OF GLASSWARE

The care of glassware is a large and important item in the bacteriology laboratory in this institution. The jars in which the sputum is collected are autoclaved after the work is done on the specimens. They are then washed in soap, mixed with a detergent and water and rinsed in running tap water. If they are not clear at that point they are put in cleaning solution for a few hours. In the evening they are placed in the electric oven and heated for 2½ hours at 200° C. Our hope that this treatment chars the possibly remaining tubercle bacilli beyond future recognition seems to be well founded as our false positive smears amount to an infinitesimal number. When the bottles come out of the oven in the morning they are stoppered and sent to the wards.

The ideal jar for sputum collection is a 4-ounce glass jar with a screw top. The screw cap not being very durable a rubber stopper is soon substituted. So long as the caps are in use they are lined before use with new waxed paper. Since these jars are difficult to obtain, we have resorted to one-fourth pound reagent bottles and 8-ounce urine bottles, or any other jar which we could get and fit with a cover. The urine bottles we etched with the letters TBC to differentiate them from the bottles which are used for urine. Diamond ink was used for etching. It was applied with a rather thin swab dipped in melted paraffin. The letters are $1\frac{1}{4}$ inches high and easy to see. TBC is also written in grease pencil on the paper caps which fit these bottles.

As to the tubes used for centrifugalization and culture, they are autoclaved, washed in soap and water with a brush, and soaked in cleaning solution overnight. Culture tubes are autoclaved for 2 hours, not only to insure the demise of the tubercle bacilli, but to dry out and harden the Petraghani medium so that it may be more easily removed from the tubes.

Jugs for 24-hour urine specimens are well rinsed with cresol solution and allowed to stand at least 15 minutes. They are then rinsed thoroughly with hot water and filled with a strong, hot solution of a detergent and allowed to stand a few minutes. They are rinsed again with hot water and drained slightly. A little concentrated nitric acid is then poured into the jug and it is rotated until it is bright and clear. A little water is added and the jug rinsed a little more. It is then rinsed under running water a short-time, stoppered with a good gauze-covered cotton plug and put into the sterilizing oven for 2 hours.

Pipettes are put into cresol solution immediately after use where they are left at least half an hour. They are then rinsed in tap water with the aid of suction, soaked in a bucket of strong, hot detergent solution for a short time, rinsed again in tap water and put into cleaning solution for a few hours or overnight. After thorough rinsing in tap water followed by distilled water they are dried in the oven. The mouthpieces are plugged lightly with cotton and the pipettes are ready to be placed in cans and sterilized in the oven for use.

Positive slides are thrown away. Negative slides are thoroughly cleaned and used again.

STAINS AND MEDIA

Since stains and concentrating solutions are used in such large quantities in this laboratory, they are placed in 1- or 2-liter bottles with a siphon arrangement. Medicine droppers make good tips for the tubing on the siphon. Slides are stained 20 at a time on an electric heating rack, and it is no trouble at all to cover them with stain or acid alcohol from a siphon.

As the 1 percent sodium hydroxide solution and 2½ percent oxalic acid solution must be kept sterile, the glass tips on the siphons of these bottles are protected from contamination by a funnel. It is arranged in this manner. The stem is removed from the base of a funnel 2½ inches in diameter, making a hole big enough to pass a piece of rubber tubing about 3½ inches long. This tubing is slipped over the end of the glass siphon. In the free end of the tubing is placed a short piece of glass tubing about 2 inches long and slightly pointed at the free end. In this way the tip of the siphon is well inside the funnel and protected from dust. Bottle, siphon, and all are sterilized in the autoclave. A fresh sterile funnel with the glass tip inside should be put on the siphon every day before beginning work. Sterile solutions can be added to the bottles in an aseptic manner, so it is not necessary to sterilize the bottle and siphon every day. If a lengthy interval occurs during use, the tip may be sterilized by letting 5 to 10 cc. of the solution run out into the discard jar; or the tip and funnel may be flamed. The percentage of contaminated cultures is really very small using this method. It is less than when the concentrating fluids are poured from a flask or added with a pipette.

The media used in this laboratory are Petraghani slants and serum broth. Serum broth is an excellent medium, in the opinion of the author, the best for spinal fluid and other small uncontaminated specimens. Unfortunately it is readily overgrown and is of little value for sputum culture or for the culture of any other material which must first be freed of pyogenic organisms. Petraghani's medium is considered by the author the medium par excellence. Most tubercle bacilli grow well on it and the growth is easy to see. We make the slants long and without an appreciable butt. When the slants come out of the autoclave they are placed in a wire basket. Paper towels are put over the top and fastened down with rubber bands. The basket is then turned upside down and placed in the incubator overnight. It is desirable that the slants be dry but not dried out before they are used. When the slants are dry the cotton stoppers are replaced by corks of a cheap grade. These corks allow just enough air to get in to supply the needs of the tubercle bacilli and are still dense enough to keep the slants from drying out. Rubber stoppers have a tendency to cause the slants to sweat and make the growth moist and smooth. Contrary to the opinion of some workers it has been found here that the heaviest, most typical growth occurs on slants that do not have excess moisture, either that of the water of condensation or that of too large an inoculum.

Where there are as many slants to read as we have here, it is a great aid to have distinctive growth as often as possible. Cultures are read

in this laboratory on one day in the week. Those that are a month old are read and the positives pulled out and reported. The negatives are put back into the incubator and the 2-month old cultures are examined and a final report given. Thus the cultures for 2 weeks are examined at one time. The total is between 350 and 500 cultures. The number of distinct positives in such a group varies between 50 and 75. There are usually 20 or more doubtful positives, that is smooth, flat, or wet looking cream-colored colonies, and some yeasts that it is desirable to see in a stained smear. If the slants are wet the number of doubtful positives is greatly increased and also the work. Smears are not made of typical dry colonies with a hole in the center, or those looking like a grain of sand, or a volcanic cone with a veil-like zone of growth surrounding the cone.

Monilia albicans grows very nicely on Petragnani's medium. If this amounts to more than a sporadic colony on a culture it is reported. The colonies are large, raised, and pearly white. Sometimes they grow mixed with acid-fast bacilli and then the colonies are rough and lacey in appearance. The acid-fast bacilli are eventually overgrown, however, and it is possible to find the growth mixed only in the beginning.

Monilia albicans produces branches on Petragnani's medium.

STAINS, SOLUTIONS, AND MEDIA

Carbol-fuchsin

Basic fuchsin.....	gm.....	12.5
95 percent ethyl alcohol.....	cc.....	150
Phenol.....	gm.....	50
Distilled water to.....	cc.....	1,000

Mix in the order given.

Malachite Green

Malachite green.....	gm.....	1.5
Distilled water.....	cc.....	1,000

This is a nice light counterstain, but it does not stain cells well. For this reason it is better to use Löffler's alkaline methylene blue as a counterstain on spinal fluid sediments.

Oxalic Acid

Oxalic acid.....	gm.....	25
Distilled water.....	cc.....	1,000

Sodium Hydroxide

Sodium hydroxide.....	gm.....	10
Sodium alum.....	gm.....	2
Distilled water.....	cc.....	1,000

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Serum Broth

Tryptose.....	gm--	20
Sodium chloride.....	gm--	5
Dextrose.....	gm--	5
Distilled water.....	cc--	1,000

Add the dry ingredients to the water and heat until they are dissolved. Dispense in 100 cc. amounts in 200 cc. flasks and autoclave.

To make serum broth simply add 15 cc. of sterile serum to flask of the tryptose broth. Serum obtained from the serology laboratory and put through a Seitz filter is very good. There is usually a small amount of hemoglobin in this serum, and it seems to enhance the value of the serum somewhat.

Modification of Petragani's medium

(For tubercle bacilli)¹

120 test tubes (150 by 16 mm.)		
Skimmed milk.....	cc--	450
Potato flour.....	gm--	18
Asparagin.....	gm--	2.6
Peeled and shredded potato.....	gm--	225
Eggs.....		12
Egg yolks (additional).....		3
Sterile C. P. glycerin.....	cc--	35
2 percent aqueous malachite-green (certified).....	cc--	30

Peel the potatoes and shred them on a plastic or metal vegetable shredder which may be purchased at any 10-cent store. Place the potatoes, potato flour, milk, and asparagin in a double boiler and cook for 2 hours, stirring constantly until the mixture becomes sticky, after which occasional stirring will suffice. Sterilize the eggs by soaking them in 70 percent alcohol for an hour, and drop the egg yolks and egg white along with the three extra yolks into a sterile liter Erlenmeyer flask, which contains a quantity of sterile glass beads. Stopper with a sterile rubber stopper and shake vigorously until the eggs are well blended. Add the glycerin and malachite-green and shake. Cool the potato milk mixture to 45° to 50° C. and add the egg-glycerin mixture slowly. Filter through sterile gauze into a sterile liter Erlenmeyer flask. The medium should be neutral to litmus.

Attach a sterile siphon similar to the ones used in the oxalic acid and sodium hydroxide bottles and distribute aseptically in sterile test tubes and inspissate carefully. This may be done in the autoclave using the following procedure:

Raise the temperature to 45° C. in the first half hour.

Raise the temperature to 65° C. in the second half hour.

Raise the temperature to 80° C. in the third half hour.

Hold at 80° C. for 20 minutes. (Be sure that the temperature stated is that inside the autoclave. It will be necessary to check the temperature given by the thermometer on the autoclave with another laid on the tubes of medium.) Allow to cool in the autoclave. Dry in the incubator overnight. Replace cotton plugs with sterile corks.

¹ COWEN, M. E., and HENDERSON, E. J.: Successful method of cultivating tubercle bacilli. *Am. Rev. Tuberc.* 29: 368-372, Mar. 1934.

*Seelman Method for Chlorides*³

SOLUTION 1

Anhydrous crystallized silver nitrate (C. P.)	gm.	20.055
25 percent solution of nitric acid in distilled water	cc.	900
Cold saturated solution of ammonioferric alum in distilled water	cc.	50
Distilled water, q. s.	cc.	1,000

SOLUTION 2

Ammonium sulfoeyanate	gm.	7
Distilled water	cc.	1,000

Method: Place 1 cc. of No. 1 solution in a small evaporating dish or small glass jar. Add 0.5 cc. spinal fluid and titrate with solution No. 2 until a rust color appears and remains 15 seconds. It is best to titrate a blank first. One cc. of solution No. 1 should give a rust color with 2 cc. of solution No. 2. The titrating should be done with a 1 cc. pipette or a 2 cc. burette graduated into hundredths. The calculation is simple. Subtract the amount of No. 2 solution used from 2.00 and multiply by 1,000 to get the amount of chlorides in milligrams percent.

Example: Titration uses 1.28 cc. solution No. 2.

2.00

1.28

.72 × 1,000 gives 720 milligrams chlorides per 100 cc. spinal fluid

In conclusion the author wishes to acknowledge the assistance received from the Laboratory Routine of the Barlow Sanatorium at Los Angeles, Calif. The work cannot be done at Sampson in the same way as it is done at Barlow, but the adaptation of their methods has worked surprisingly well.

³ LEVINSON, A.: *Cerebrospinal Fluid in Health and Disease*. 2d edition. C. V. Mosby Company, St. Louis, Mo., 1923. pp. 182-183.

THE DIAGNOSIS OF COMBAT FATIGUE

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Combat fatigue was well recognized as one of the most frequently occurring disorders in the United States Navy in World War II. Considerable interest is understandably being shown in its incidence, prevention, and treatment, but the validity of any statistical study of such a condition depends basically on the accurate diagnosis of the cases used. Experience in the field by the writer has demonstrated recently that in a Marine division during a prolonged combat operation, 22 percent of the cases admitted to the division field hospital as combat fatigue were incorrectly diagnosed. Furthermore, of all cases of true combat fatigue seen, 13 percent were admitted with some other incorrect diagnosis. Discussion with psychiatrists of other Marine divisions corroborated the existence of wide variations in the use of the term "combat fatigue."

Definition.—Combat fatigue has been defined in *Bumed News Letter* No. 4, volume 4, 18 August 1944. The article is quoted verbatim because of its importance and relevance:

Combat Fatigue: The attention of medical officers is called to the importance of the proper use of diagnostic terms, particularly with respect to psychiatric terminology. Medical records are permanent official documents which have medico-legal importance. It is especially important that diagnoses of the various psychoneuroses be made only when the symptoms are readily demonstrable; such diagnoses can never be made by exclusion.

The diagnoses "Combat Fatigue" and "Operational Fatigue" were included in Navy nomenclature in order to designate certain psychosomatic conditions and to prevent the term, "psychoneurosis," from being placed upon a man's record until such a time as the presence of a neurosis is confirmed by careful study in a hospital. The deficiencies of the terms are recognized, but the terms are for intra-mural use; no one is ever discharged from the Navy with a diagnosis of Combat or Operational Fatigue. The term implies that the congeries of symptoms which result from combat or long-continued operations under difficult conditions will clear up when the precipitating factors are removed and the patient is treated by rest and sedation.

In order to prevent these diagnoses from becoming convenient "scrap baskets" into which various syndromes are pushed, the following diagnostic criteria for Combat and Operational Fatigue diagnoses should be satisfied:

1. The patient should have demonstrated a stable personality prior to the appearance of symptoms, i. e., no evidence of gross maladjustment in childhood or adolescence, and should have a previous service record indicating his competence and stability.

2. He should have been exposed to combat or operational experience of sufficient intensity and duration to be capable of producing the symptoms.

3. The illness should be one from which the patient is expected to recover.

4. He should manifest objective evidence of subjective anxiety; i. e., physiological manifestations. The symptoms evidenced by these patients are fairly uniform.

They are:

(a) Heightened irritability (startle response, night terrors, vigil state, etc.).

(b) Autonomic nervous system symptoms (tachycardia, gastro-intestinal disturbances, etc.)

(c) Fatigue—a diminished capacity for work.

(d) Personality changes in the direction of anxiety, panic, apathy, confusion, depression, etc.

These patients should nearly all recover following rest, sedation, and short term reeducative psychotherapy.—(W. F. K.)

The purpose of the present paper is to elaborate and illustrate the above definition.

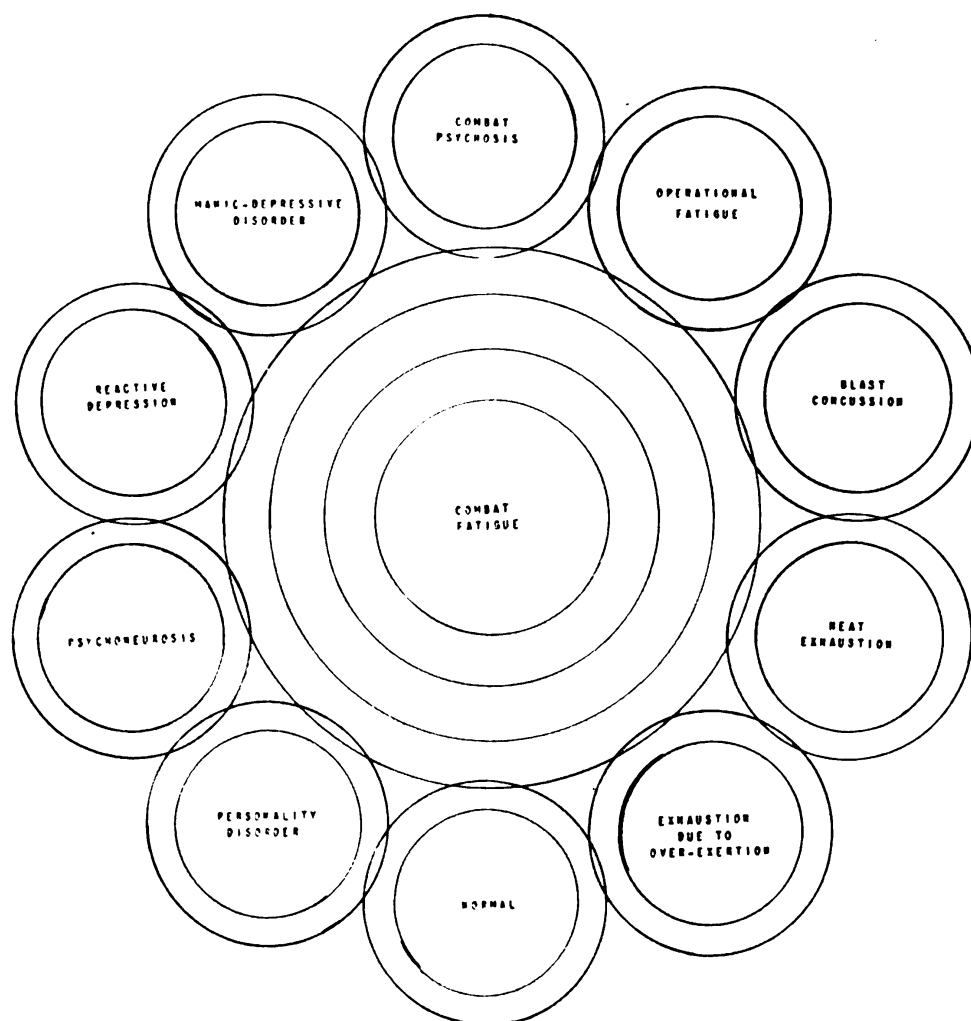


FIGURE 1.—Combat fatigue in its relation to other diagnoses. (The circles should be considered as expanding until they overlap.)

Related conditions.—Figure 1 shows combat fatigue surrounded in symbolic fashion by 10 other diagnoses. The figure is intended to illustrate the position of combat fatigue in the constellation of other diagnoses that are related to it. The widening concentric circles are presumed to convey the notion that none of the diagnoses are necessarily fixed, rigidly defined entities, but rather that their peripheral boundaries merge into one another in such a manner as to make their distinction a somewhat arbitrary matter. The particular order in which they are arranged is not felt to be significant, though in general, conditions which are largely impersonal are placed to the right of normal, while those that are largely personal are placed to the left. It is to be noted that the purpose of the figure is to exploit the radial relationship of combat fatigue to the 10 surrounding diagnoses and not the circumferential relationship of the 10 diagnoses to one another.

In peacetime, the space now filled by combat fatigue is easily covered by the expanded peripheries of the related diagnoses. When war comes, combat fatigue bursts among them like a powerful nova.

Differential diagnosis

The following paragraphs are an attempt to draw the approximate lines of demarcation between combat fatigue and its related conditions, on the basis of practical data confronting the psychiatrist in the field.

1. *Normal.*—The line between the normal and combat fatigue must be drawn on two occasions: when the decision is made to enter the patient on the sick list with the diagnosis of combat fatigue, and when the patient is presumed to have recovered so that he may be returned to duty.

It must be remembered that the symptoms of combat fatigue are essentially exaggerations of the symptoms experienced by all normal men in battle. The earliest of these are the common physiological results of fear, e. g., inner tension and restlessness, palpitation, profuse sweating, dryness of the mouth, and digital tremor. As the fear is prolonged, other symptoms develop, e. g., increased startle reaction, loss of appetite, insomnia, disturbing dreams, marked fatigue, inability to concentrate, irritability, and perhaps diarrhea or urinary frequency. If there is an abrupt change from these symptoms to a hysterical outburst, or acute grief reaction, or complete collapse, the diagnosis of combat fatigue is easy to make. If, however, as is often the case, the symptoms increase gradually in severity as combat is continued, a decision must be made as to the point at which the individual will be declared incapacitated.

This decision is one for both the patient and the medical officer. Individuals vary tremendously in the amount of symptoms they are willing to tolerate before they turn themselves in. The same is true in such things as catarrhal fever. Medical officers also vary in their read-

iness to turn in patients with combat fatigue just as they do to turn in patients with catarrhal fever. Some medical officers become known as "easy," some as "tough." In combat, the proper attitude is one that considers the tactical military situation. If the going is successful, and casualties are light and replacements are plentiful, patients with combat fatigue may be admitted to the sick list readily. The earlier that treatment is started the more certain is complete recovery. If fighting is heavy and there are many casualties and few replacements, then every man may be needed at all costs and the medical officer must tighten up, even at the risk of more serious neuropsychiatric disturbances later. In other words, when the military going is "easy," the medical officer can be "easy," but when the going is "tough," he must also be "tough."

A comparable situation exists when a patient with combat fatigue is improving. When should he be sent back to duty? The decision must depend not only on the degree of improvement, but on the degree of need for the man back in his outfit. It is a mistake to feel that the patient must be entirely symptom-free before he is returned to the front. Most of his comrades who have remained at the front are far from symptom-free themselves. If the need for men is urgent, the medical officer must again be "tough." His responsibility is first to the service, and second to the individual patient. It is not advocated that men who are unfit be turned out of the sick bay. But fitness for duty is a relative matter. It depends on the man and it depends on the duty. The medical officer working with combat fatigue patients must keep himself informed regarding the current military situation.

2. *Exhaustion due to overexertion.*—

Case. 1.—A 19-year-old Marine private, first class, after several days of heavy fighting, ran across a 500-yard stretch of low ground raked by enemy fire. He was laden down with ammunition which was badly needed at the front outpost. When he arrived, he collapsed and sobbed uncontrollably. He was turned in with combat fatigue. An hour later at the field hospital he had recovered his self-control, and in response to questioning said, "I suppose I'm as nervous as the rest of them, but I was just worn out, Doc. I'm all right now. Can I go back to my buddies? They need me." He was kept overnight and returned to duty. The diagnosis was changed to "Exhaustion due to overexertion." Reason—error.

The physical strain of combat is often completely exhausting. Loss of emotional control with exhaustion is a familiar observation. Often it is the very best fighting men who wear themselves out so completely. These men (often commissioned or noncommissioned officers) recover rapidly with rest alone and their neurotic symptoms are minimal or absent.

3. *Heat exhaustion.*—

Case 2.—A 20-year-old Marine private collapsed during a brisk attack involving rapid movement. It was mid-afternoon of a very hot, cloudless, humid day. He was carrying full battle equipment and had had no noon meal, or salt tablets.

He seemed dazed and was turned in with a diagnosis of combat fatigue. On examination at the field hospital he was flushed, had a rapid pulse and temperature of 101° F. He complained of severe headache and nausea and vomited. He was restless but showed little anxiety except for his physical condition. With intravenous saline, salt tablets, and sedation he recovered completely in 2 days. Diagnosis was changed to "Heat exhaustion." Reason—error.

The Physical evidence of being overheated plus lack of gross neurotic symptoms is usually sufficient to establish the proper diagnosis.

4. *Blast concussion.*—

Case 3.—A 25-year-old Marine private was partly buried in his foxhole by an exploding shell. He was dazed but not unconscious. At the field hospital he complained of severe headache, ringing in the ears, deafness, soreness of the chest and abdomen, and pain in his right hip where he had been bruised. His right eardrum was lacerated. He had been "scared stiff," and was still tremulous. His recovery was gradual, being complete in 2 weeks. Diagnosis—Concussion, blast atmospheric.

Case 4.—A 23-year-old Marine private turned himself in at the battalion aid station, saying, "A mortar went off near me and knocked me silly." He cried uncontrollably, spoke of his buddies being killed. He was sent to the field hospital with a diagnosis of blast concussion. The physical examination was found to be negative, and he had numerous persistent neurotic complaints. The diagnosis was changed to combat fatigue. Reason—error.

Patients with true blast concussion are frequently misdiagnosed as combat fatigue, particularly when the patient is dazed and an accurate history is not obtained. Patients with true combat fatigue often exaggerate the nearness of an explosion as a respectable explanation of their symptoms. In blast concussion, emotional symptoms should disappear rapidly. In combat fatigue there should be no abnormal physical findings or characteristic physical symptoms. There is rarely any difficulty in the distinction. Occasionally, both conditions may occur simultaneously in the same individual, the blast being "the last straw."

5. *Operational fatigue.*—

Case 5.—A 34-year-old Marine sergeant was turned in by his commanding officer during combat because of increasing inefficiency and personality change. He was sent to the field hospital with a diagnosis of combat fatigue. The patient had been in three previous combat operations and was in his thirty-first month overseas. His symptoms dated back several months to the last operation. In the current operation he had seen no actual combat since he was in charge of quartermaster stores. The diagnosis was changed to "Operational fatigue." Reason—error. The patient was evacuated.

The diagnosis of combat fatigue should not be made in the absence of actual current combat. The symptoms of operational fatigue may include any of those seen in combat fatigue, though usually the acute symptoms are absent and there is predominance of chronic fatigue, loss of weight, loss of interests, mild depression, inattentiveness, and perhaps irritability and seclusiveness. The patients look strikingly listless and worn.

6. *Personality disorder.*—

Case 6.—An 18-year-old Marine private was in his first combat operation. The beach landing had been "cold" and he was on his first patrol. No Japs were sighted. The second night he was found crying hysterically. He had hardly eaten since leaving the ship and he could not sleep. He was turned in with combat fatigue. He was the youngest of five children in an unstable home, had enuresis to age 15, inability to stay at camp or boarding school because of nostalgia and frequent fainting attacks on excitement or sight of blood. At boot camp he was studied by the aptitude board, but was not rejected. The diagnosis was changed to "Personality disorder." Reason—error, and he was evacuated.

Neuropsychiatric screening has not been successful in weeding out all the unfit. When it is obvious that the patient's symptoms cannot be due primarily to the strain of actual combat since combat has been absent or minimal, and that the constitutional personality make-up is abnormal, whether due to inadequacy, instability, paranoid trends, psychopathy, or homosexuality, the diagnosis of combat fatigue should not be made.

7. *Psychoneurosis.*—

Case 7.—A 24-year-old Marine second lieutenant was in his first combat operation with a responsible position in the R3 office. He became increasingly "nervous," ate poorly, slept restlessly, vomited frequently after meals. When he became irritable and inefficient, he was sent to the regimental surgeon and a diagnosis of combat fatigue was made. He had had to leave college one year because of a similar train of symptoms just before final exams. He had had neurotic symptoms off and on for years and had had a great deal of medical attention without benefit. He had not been in actual combat. The diagnosis was changed to "Psychoneurosis, Anxiety." Reason—error, and he was evacuated.

The remarks made under personality disorder above apply with modification here. Difficulty in diagnosis occurs only when the patient has been in a certain amount of actual combat, and his past history is not conclusive. When he is among the first to break down when others under the same or greater stress do not, it is clear that his inherent neurotic make-up has played an important role. However, if there has been exposure to combat of any severity, the patient should be given the benefit of the doubt and the diagnosis of combat fatigue should be made.

8. *Reactive depression.*—

Case 8.—A 27-year-old hospital corpsman, overseas 20 months was in his second combat operation, serving in an aid station with a Marine battalion. He received a letter stating that his wife was pregnant. He became extremely upset, cried, refused to eat, and spoke of wishing he were dead. The chaplain was unable to help him. Previously the patient had conducted himself well in spite of severe combat conditions. He was clearly depressed and entertained suicidal thoughts. The diagnosis was changed to "Reactive depression." Reason—error, and he was evacuated.

9. *Manic-depressive disorder.*—

Case 9.—A 26-year-old Marine private, first class, was turned in toward the end of a long campaign with three of his friends, all diagnosed combat fatigue.

The patient had done well as a rifleman until the past few days when he became unusually quiet, seclusive, looked dazed, and moved about as though automatically. He showed no startle reaction, expressed no anxiety or fear. He gave a history of similar episodes, lasting a few days to a few weeks, occurring several times a year for the past 9 years. He had had considerable medical and psychiatric attention and had been hospitalized once after a suicide attempt. A maternal uncle had committed suicide. The diagnosis was changed to "Manic-depressive disorder." Reason—error, and he was evacuated.

Patients with combat fatigue may be depressed, but the depression is minor and inconspicuous among the neurotic symptoms. Occasionally a manic state appears in combat, but the differentiation of this from combat fatigue should cause no difficulty. The absence of anxiety is always striking.

10. *Combat psychosis*.—

Case 10.—A 20-year-old Marine private, first class, was exposed to prolonged heavy shelling in his first combat operation. There were many casualties about him. He began to act strangely. He ate practically nothing, showed extreme startle reaction, stayed on the lookout whether he was on or off watch, and muttered to himself about the Japs. He seemed not to notice his comrades. One day he was found wandering aimlessly in a forward area. He was out of contact, incoherent, but quiet and passive. A diagnosis of "Combat psychosis" was made.

The diagnosis of combat psychosis is not in the official nomenclature. Cases like the one described above illustrate the need for it. These cases are not instances of severe combat fatigue. Fortunately, they are not common, but when they occur the problems involved in management, treatment, prognosis, and disposition are entirely different from those in combat fatigue. It would seem desirable that the diagnostic tag used in such patients should be different and appropriate to the condition right from the start.

11. *Miscellaneous*.—Almost any neuropsychiatric condition may occur in combat, either precipitated by the stress and strain, or coincidentally. Often such a condition is misdiagnosed as combat fatigue by harassed medical officers at the front lines, though the proper diagnosis is not difficult to make later when there is time for a complete examination. Examples are: cerebral malaria, meningitis, cerebral trauma, toxic psychosis, schizophrenia, and malingering.

CONCLUSION

Combat fatigue is a diagnosis that should be used within clearly defined limits and not loosely for any neuropsychiatric condition which occurs in combat. The definition of combat fatigue is here implemented with a discussion of related conditions and illustrated by the case histories of actual patients seen in the field.

TESTS ON THE PREVENTION OF FRACTURE OF GLASS CONTAINERS DUE TO FREEZING OF THEIR LIQUID CONTENTS¹

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The breakage of glass containers due to expansion of their liquid contents upon freezing is a matter of importance. Several factors have been analyzed by the Naval Medical Research Institute at Bethesda, Md., among which were the shape, size, method of stowage of such containers, and the volume of liquid. Solutions in which water is the solvent expand approximately 10 percent upon freezing; therefore a reduction in the liquid volume by 10 percent would be a prerequisite. Some tests have been made to elucidate various factors of this problem.

PROCEDURE

Experiment a.—Ten pairs of differently shaped and stoppered glass containers of different volumes were filled to 80 percent of their indicated capacity with tap water and stoppered. The indicated capacity of a container generally is less than the measured volume. Of each pair, one was set in an upright, and the other in an inverted position in the deep-freezing refrigerator at -10° C. for 24 hours. The following containers were tested:

- 500 cc. pyrex Erlenmeyer flasks, cork stoppered.
- 250 cc. pyrex Erlenmeyer flasks, cork stoppered.
- 250 cc. pyrex Erlenmeyer flasks, glass stoppered.
- 150 cc. round pyrex flasks, rubber stoppered.
- 125 cc. pyrex Erlenmeyer flasks, cork stoppered.
- 120 cc. cylindrical, narrow-necked, glass bottles rubber stoppered.
- 60 cc. cylindrical, glass, dropper bottles, dropper top in closed position.

¹ On 26 November 1946 Lt. J. E. Owen (DC) U. S. N. visited the Naval Medical Research Institute for a conference relative to dental research which might be undertaken in Operation Highjump. The breakage of glass containers due to freezing of their liquid contents was one of the problems presented.

60 cc. cylindrical, wide-mouthed, brown, glass bottles with bakelite screw caps.

35 cc. cylindrical, wide-mouthed, glass bottles with metal screw caps.

30 cc. cylindrical, wide-mouthed, glass bottles with metal screw caps.

Experiment b.—The experiment was repeated with the containers filled to 90 percent of their indicated capacity, excluding the 500 cc. Erlenmeyer flasks.

Experiment c.—Experiments *a* and *b* were repeated with pairs of the same types of bottles. The temperature, however, was maintained at -15° C. for 24 hours. In addition, the following type containers were included again excluding the 500 cc. Erlenmeyer flasks:

650 cc. cylindrical, wide-mouthed, glass jars with metal screw caps.

530 cc. cylindrical, wide-mouthed, glass bottles with metal screw caps.

240 cc. rectangular, narrow-necked, glass bottles, with composition screw caps.

120 cc. rectangular, narrow-necked, glass bottles with composition screw caps.

120 cc. cylindrical narrow-necked, glass bottles, with stopper, a longer bottle than the 120 cc. narrow-necked, cylindrical bottle used in experiment *a*.

The containers of the volumes indicated were chosen since they generally represent those which naval dental officers use most frequently. Since the precision with which each container is duplicated by the manufacturer could not be measured, those factors were ignored in the experiments. It was not considered within the scope of this study to determine what effect such factors would have upon the results here obtained.

RESULTS

a. Of the 10 pairs of glass containers filled to 80 percent capacity with tap water and frozen, the 500 cc. Erlenmeyer flask which had been set in an upright position, and one 60 cc. cylindrical brown bottle set in an inverted position in the refrigerator, fractured. No other containers were fractured (table 1).

b. In the series of nine flasks which had been filled to 90 percent capacity with tap water prior to freezing, the upright and inverted 150 cc. round pyrex flasks; the 125 cc. and the 250 cc. Erlenmeyer flasks; and the 250 cc. Erlenmeyer flasks closed with ground glass stoppers fractured upon the freezing of their liquid contents. The inverted 60 cc. dropper bottle fractured but the upright one remained unbroken. Neither the upright nor the inverted 120 cc. glass, narrow-necked, cy-

lindrical containers broke. Likewise the upright and inverted 60 cc. wide-mouthed, cylindrical, brown glass bottles with composition screw caps, and the 35 and 30 cc. wide-mouthed glass bottles with metal screw caps remained unbroken.

c. Of the 14 pairs of containers which were filled to 80 percent indicated capacity prior to freezing at -15° C. for 24 hours, the following fractured: the inverted 650 cc. cylindrical jar, upright 530 cc. cylindrical bottle, inverted 240 and 120 cc. rectangular bottles, and the upright 120 cc. long, cylindrical, narrow-necked bottle. No other containers fractured (table 1).

TABLE 1.—Effect of exposing glass bottles containing water to -10° and -15° C. for 24 hours

Description of containers	Filled to 80 percent indicated capacity				Filled to 90 percent indicated capacity			
	Experiment a (-10° C.)		Experiment c (-15° C.)		Experiment b (-10° C.)		Experiment c (-15° C.)	
	Up-right	In-verted	Up-right	In-verted	Up-right	In-verted	Up-right	In-verted
1. 650 ml. cylindrical, metal screw cap			(*)	X			X	X
2. 530 ml. cylindrical, metal screw cap			X	(*)			X	(*)
3. 250 ml. pyrex, Erlenmeyer flask, ground glass stopper	(*)	(*)	(*)	(*)	X	X	(*)	X
4. 250 ml. pyrex, Erlenmeyer flask, cork stopper	(*)	(*)	(*)	(*)	X	X	X	X
5. 240 ml. rectangular, composition screw cap			(*)	X			X	X
6. 150 ml. pyrex, round flask, cork stopper	(*)	(*)	(*)	(*)	X	X	(*)	(*)
7. 125 ml. pyrex, Erlenmeyer flask, cork stopper	(*)	(*)	(*)	(*)	X	X	(*)	X
8. 120 ml. rectangular, composition screw cap			(*)	X			(*)	X
9. 120 ml. long cylindrical, narrow neck			X	(¹)			X	X
10. 120 ml. cylindrical, narrow neck, cork stopper	(*)	(*)	(*)	(*)	(*)	(*)		
11. 60 ml. dropper bottle, narrow neck	(*)	(*)	(*)	(¹)	(*)	X	(*)	(*)
12. 60 ml. cylindrical, brown, wide mouth, composition screw cap	(*)	X	(*)	(*)	(*)	(*)	(*)	(*)
13. 35 ml. cylindrical, wide mouth, metal screw cap	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)
14. 30 ml. cylindrical, wide mouth, metal screw cap	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)
15. 500 ml. pyrex, Erlenmeyer flask, rubber stopper	X	(*)						

X indicates fracture of container.

..... indicates that the specified containers were not used in the experiment.

* indicates containers did not fracture.

¹ Fell on side and froze.

Of the 14 pairs of containers which were filled to 90 percent of their indicated capacity prior to freezing at -15° C. for 24 hours, the following fractured: both the upright and inverted 650 cc. cylindrical glass jars; upright 530 cc. cylindrical bottle; both upright and inverted 240 cc. rectangular bottles; inverted 120 cc. rectangular bottle; inverted 250 cc. Erlenmeyer flask (ground glass stopper); both upright and inverted 250 cc. Erlenmeyer flasks (cork stoppered); both

upright and inverted 120 cc. long, cylindrical narrow-necked bottles; and the inverted 125 cc. Erlenmeyer flask. No other containers fractured (table 1).

It will be noted that a greater number of the cylindrical type containers of capacities less than 120 cc. withstood breakage upon freezing of their contents than did the containers of other shapes when filled to either 80 or 90 percent capacity and stoppered.

Regardless of the shape of the container or its position during the freezing of its liquid content (tap water stoppered prior to freezing), fewer fractured when filled to 80 percent capacity than when filled to 90 percent capacity.

CONCLUSIONS

From these experiments it appears that glass containers ranging in volume from 30 to 250 cc. may break less frequently than larger containers upon freezing of their liquid contents if filled to 80 percent or less of their indicated capacity.

A cylindrical container of less than 120 cc. capacity may be less liable to fracture upon freezing of its liquid contents than containers of other shapes.

The position of the container on the shelf or within the crate, apparently plays no role in the fracture of glass containers due to freezing of their liquid contents.

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THE STORY OF ELISHA KENT KANE, SURGEON, U. S. NAVY

MOSES C. SHELESNYAK

Lieutenant Commander H(S) U. S. N. R.

The discoveries made by this truly remarkable man and excellent officer will be regarded as invaluable contributions to science. He advanced in those frozen regions far beyond his intrepid predecessors whose explorations had excited such admiration. I commend the results of his explorations as worthy of the attention and patronage of Congress.—*From the Annual Report of the Honorable James C. Dobbin, Secretary of the Navy, dated December 3, 1855.*

The front ranks of explorers of the North—navigators, geographers, sailing masters, hydrographers—include men of the U. S. Navy: Peary, Byrd, DeHaven, DeLong, MacMillan, Krusen, Ronne, and many more. Among them was a surgeon of the United States Navy who participated in his first Arctic expedition as medical officer, and in his second as commander—Elisha Kent Kane.

This is his story.

Elisha Kent Kane was born in Philadelphia on 3 February 1820, the eldest son of the Honorable John K. Kane, who presided over the United States District Court for the Eastern District of Pennsylvania. Among his ancestors is one of special interest to students of Navy medicine, Mrs. Martha Gray. Her assiduous assistance to the 900 sick and wounded prisoners in Philadelphia during the British occupation of that city has been the object of great admiration. It is for Martha Gray that the women's naval medical auxiliary, Gray Ladies, has been named.

Although his physical frame was without distinction, he possessed a great reserve of hidden strength. As a youth, Elisha Kane was remarkable for his activity, his restless energy of mind and body, his daring and venturesome disposition. As a student in the University of Virginia, he displayed remarkable proficiency in his favorite subjects, natural science and mathematics, and inattention and indifference in other departments. He chose civil engineering as his future profession, but when he was 18 years old, he suffered a violent attack of rheumatic fever, from which heart damage persisted to a greater or lesser degree during the remainder of his life. In his nineteenth year his health had improved sufficiently for him to begin



—From Elisha Kent Kane, by William Elder, Childs & Peterson, Publishers, Philadelphia, Pa., 1858.

the study of medicine under the tutelage of Dr. Harris of Philadelphia. With such ardor and success was his pursuit of the practice of healing that in October 1840, while he was still an undergraduate, he was elected one of the resident physicians of the Blockley Hospital. The following year he filled a vacancy among the senior resident physicians, and yet it was March 1842 before he completed his regular course of medical studies in the University of Pennsylvania and received his doctor's degree.

He passed successfully the examination for the post of assistant surgeon in the United States Navy and in May 1843 sailed with Caleb Cushing on his diplomatic mission to China. The vessel to which he was attached, the *Brandywine*, commanded by Commodore Parker, touched Bombay, Ceylon, and Macao. In the course of the next few years, Surgeon Kane visited the Philippine Islands and explored the celebrated volcano of Tael on the Island of Luzon; made a journey through the interior of India; traversed the Himalayan Mountains; reached Alexandria, visited the land of the Nile, Thebes, the Pyramids, the Second Cataracts, and the Temple of Rameses. From Egypt he proceeded to Greece, and thence on by the Adriatic Sea to Venice, from Venice through Germany, Switzerland, France, England, and in August 1846 reached the United States.

Shortly thereafter he sailed as assistant surgeon on the frigate *United States* under orders of Commodore Reed. The mission of this vessel was to aid in the suppression of the slave trade. During Kane's residence near the Kingdom of Dahomey, one of the great African slave marts, he had an opportunity of exploring this part of the world. Here he suffered a violent attack of malaria and became so debilitated that it was necessary for him to return to the States.

After many months of assiduous care and nursing, he regained his energy and applied to President Polk for permission to join the United States Army in Mexico with a military commission. The war between the United States and Mexico was in progress and Dr. Kane could not rest idly by.

He journeyed to New Orleans and sailed to Vera Cruz, advanced to the position held by the American Army at Perote, where one of the most romantic incidents of his life took place. The hostile territory through which he was attempting to advance was filled with guerillas and it became necessary for him to obtain escort. A renegade Mexican, Domingues, who entered the American service together with a large number of his outlawed desperados accompanied him toward Mexico City. However, when they arrived at Nopaluca, news that a body of Mexican troupes was approaching panicked Domingues who proposed to retreat. Kane resisted this proposal and threatened vengeance by the American Government. When the two hostile parties

came in sight of each other Kane commanded his men to charge, and led them with the leadership of a veteran. Distinguished General Gaona led the Mexican detachment. With him was his son, a young officer of great promise. In the course of the battle, Dr. Kane's horse was shot from under him, but he continued to fight a brief but decisive action. General Gaona and his son were both wounded. General Torrejon, 5 officers and 40 men were taken prisoners. Dr. Kane himself was slightly wounded.

The most dramatic episode remained to be enacted. Young Gaona was bleeding from a wound in the lungs and Dr. Kane succeeded in tying a severed artery, saving the life of his gallant foe. As the party and its prisoners journeyed onward, the renegade Domingues sought to reap vengeance by putting the captives to death. Dr. Kane opposed this violence and threatened to shoot the first man who laid hands on a prisoner. General Gaona repaid Kane for this gallantry when he and his family nursed the doctor back to health during an attack of typhus.

As soon as he was sufficiently recovered to travel, Dr. Kane hastened to Mexico City, delivered his dispatch to General Scott and remained there until peace was proclaimed. In 1849 Elisha Kane made a voyage to the Mediterranean on the store ship *Supply* and there added to his list of bodily ailments—lockjaw. He returned to the States in an attempt to recover his health.

In 1848 apprehension was felt for the safety of the Sir John Franklin Expedition, and the British Government dispatched Sir James Ross in command of the *Enterprise* and the *Investigator* to search for the Franklin Expedition. During the next 15 years different expeditions were sent forth, publicly and privately supported, in the hope that some revelation of the ultimate fate of this group could be found.

The first American expedition in search of Sir John Franklin was under command of Lt. E. J. DeHaven, and Elisha Kent Kane was the medical officer attached. He held the post of passed assistant surgeon with the *Advance*. On 22 May 1850, the *Advance* and the *Rescue*, two small brigs appropriated by the Government for this expedition sailed from the port of New York. Their mission was under way. Newfoundland was reached on 7 June by the *Advance* and here the adventurers had their first view of an iceberg. On 3 July after having stopped to obtain information and furs from the Danish inspectors of north Greenland at Lively, the vessels passed Black Head; and on 6 July, they approached Upernavik, the last Eskimo settlement known to them. Two days later they found themselves wedged into pack ice, where they remained imprisoned for 21 days, until the wind changed, the floes opened wider, and they sailed northward. The *Advance* and the *Rescue* resumed their progress slowly northward and reached Cape

York and Dudley Diggs. On 19 August the expedition passed beyond the limits of Baffin Bay where they discovered two vessels of the British Government also in search of Sir John Franklin.

About a week later the American vessels reached Cape Riley where two cairns were discovered. Dr. Kane inspected these and concluded they were actual traces of Sir John Franklin's party. Two days later after proceeding from the *Advance* over ice to the frozen shore of Beechey Island, Dr. Kane and Commander Philips of the English Squadron found a piece of canvas with the name of one of Franklin's ships—*Terror*—inscribed on it, a large number of tin cannisters filled with meat, anvil block, various bits of clothing, and three graves side by side. They found other traces several hundred yards further on and a deposit of over 600 preserved meat cans, but still no written memo as to the date or experience or condition.

On 9 September the Expedition entered Lancaster Sound. On the tenth of the month one of the most exciting incidents in Arctic exploration occurred when all the vessels then cruising in the arctic in search of Sir John Franklin met by chance opposite Griffith Island: The *Resolute*, the *Intrepid*, the *Assistance*, the *Pioneer*, the *Lady Franklin*, the *Sofa*, the *Advance* and the *Rescue*. The American expedition was destined to spend a winter in the Arctic.

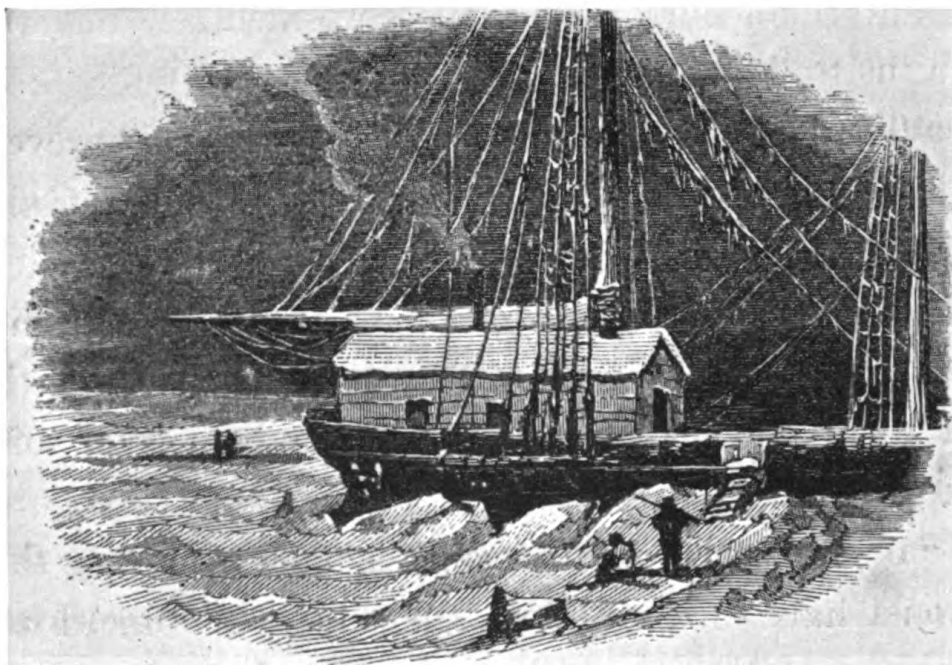
The *Advance* and the *Rescue* were both wintered in. On 30 October, a housing cloth was put over the *Advance* and the officers and crew of the *Rescue* boarded her. Arrangements were then complete for wintering in Griffith Inlet. Commander DeHaven writes in his narrative:

As the season advanced, the cases of scurvey became more numerous; yet they were all kept under control by the unwearied attention and skillful treatment of the medical officers. My thanks are due to them, especially to Passed Assistant Surgeon Kane, senior medical officer of the expedition. I often had occasion to consult with him concerning the hygiene of the crew; and it is in a great measure owing to the advice which he gave and the expedients that he recommended that the expedition was enabled to return without loss of life.

Next spring, on 10 May 1851 the squadron forced its way into a clear and open sea, latitude $65^{\circ}30''$ and on 8 July made the Danish settlement of Upernavik. The *Advance* reached New York on 30 September.

Dr. Kane after his return from the first Arctic expedition spent most of his time in preparation of the records of his journey which were published by Harpers titled "Personal Narrative." Schmucker describes this work in the following glowing words:

It is a production of great ability, superior, indeed, in a literary point of view, to the narrative of his second expedition, because the subject was then fresher, his own powers less exhausted, and his leisure to make researches during the cruise was more ample than when the chief care and responsibility of an expedition rested upon him. His first work is probably the most "systematic," the most important which has yet appeared in relation to Arctic exploration and discovery. It evinces extensive and accurate scientific attainments, vision and intelligent



The Brig in May

—From *Arctic Exploration*, by E. K. Kane, Childs & Peterson, Publishers, Philadelphia, Pa., 1857.

observation, unwearied industry, intense interest in the various aspects of the subjects under examination; while at the same time, the style is polished, correct, and attractive.

Although during the summer of 1853, Dr. Kane's health was poorer than usual, the interval between the first and second expedition was one of extreme activity. He lectured in Northern and Eastern States on exploration, he wrote extensively on his first expedition, and was involved in admiralty arguments over the priority of discoveries of Grinnell Land. Dr. Kane centered his interest on the planning of a second expedition and expended much time and energy attempting to get results and financial assistance. Although the expedition was supported by the Navy Department, additional help was derived from Mr. Peabody, Mr. Grinnell, the Smithsonian Institute and others. The Secretary of the Navy, at that time, John P. Kennedy, placed Dr. Kane on special duty in charge of the expedition. His greatest toils and severest disappointments were connected with his efforts to get appropriations from Congress. The only result of his efforts was the acquisition of several thousand dollars worth of material from the Medical Bureau at Washington.

Although it was 10 years since the Franklin expedition was last heard from, Dr. Kane felt certain that the rescue of Sir John Franklin was still feasible. To the student of the Arctic, it is interesting to note that Dr. Kane was among the first of the school made famous by

Stefansson which had the conviction that life could be supported in the Arctic climate by hunting and that extreme cold need not destroy human existence with proper protection that knowledge of the Arctic could afford.

In December 1852 Dr. Kane received official orders from the Secretary of the Navy to conduct his second expedition. All the necessary preparations were made and on 30 May 1853 he sailed from the port of New York. A month later he entered the obscure harbor of Fiskernaes. After a hazardous voyage, Dr. Kane reached, on August 23, 78°45' N. Latitude, farther north by vessel than any of his predecessors. Further progress was extremely difficult and impeded by ice which was becoming progressively consolidated.

A sledge trip was made to explore the coast for harboring purposes, but after difficult travel of less than 40 miles in 5 days, Commander Kane decided to stay. The vessel was destined never to leave that spot. On 10 September the contents of the hold of the ship were removed and deposited in a storehouse on Butler Island. A deckhouse was constructed on the vessel and the construction of an observatory a hundred yards from the brig on a rocky inlet was begun. Here transit and theodolite were placed. The magnetic observatory was placed close by and a meteorological observatory built on the open field ice. This was the first truly scientific Arctic station.

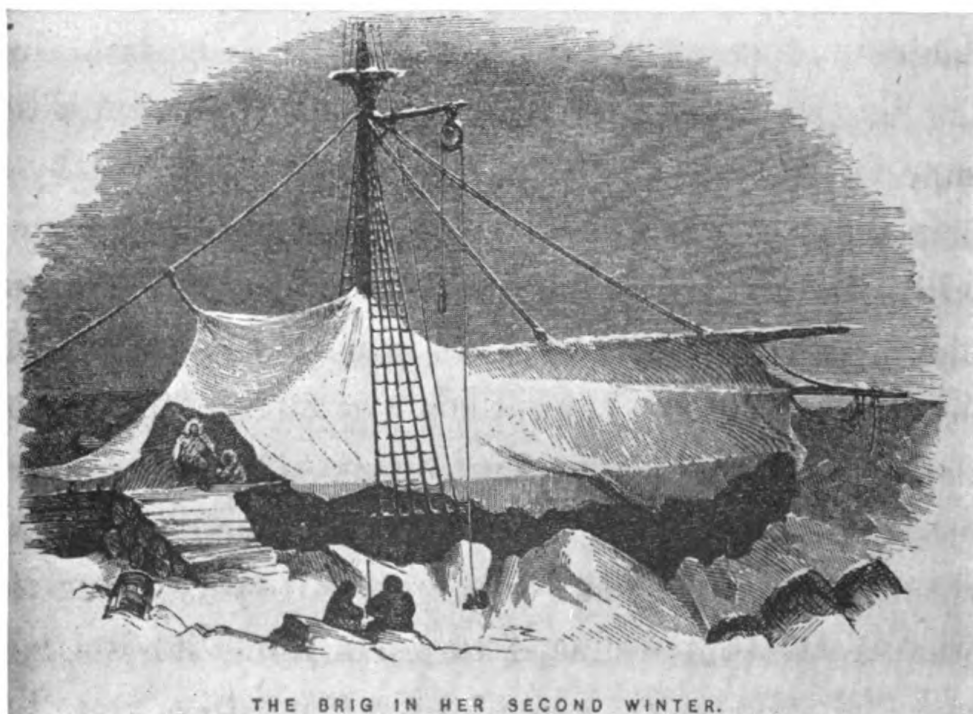
After a winter of intense cold, during which time Dr. Kane continued all his scientific experiments and astronomical observations, the first glimpse of returning light was seen on 21 January. On 19 March, a sledge party was organized for further explorations. After some days Dr. Kane was surprised to see a portion of the party return. They had left their comrades some 40 miles away, and in imminent danger. Commander Kane immediately started his relief expedition, and in temperature hovering around 68° below, they traveled for 18 hours without food or water and reached the tent of the four absent men who were found lying on their backs calmly awaiting relief or death. During this trip, Dr. Kane's beard was frozen fast to his buffalo skin coat and could be released only by cutting it.

After many hours, the whole party returned to the brig alive; some men were delirious and others suffered from snowblindness. Two eventually died in consequence of their exposure.

On 25 April another sledge journey was undertaken with the intention of reaching the extreme limits of the coast of Greenland. In the course of this journey, Dr. Kane discovered Great Humboldt Glacier—a shining wall of ice 300 feet high, extending along an unbroken front of 60 miles.

On 4 June, another party was sent out for further exploration under the command of William Morton. Morton climbed a lofty peak in

order to survey his future route, and from here saw an extensive plain stretched away toward the north, which proved to be the great Humboldt Glacier as viewed from the interior. Morton's party traveled northward and eventually reached a point about 500 miles south of the pole. From an elevation named Mount Edward Parry, at the extreme northern point of land known to exist, Morton beheld toward the north from this elevation of about 400 feet, a boundless waste of water stretching away to the pole—not a particle of ice on its surface. Here was a fluid sea in the midst of whole continents of ice. Since they had only sledges, it was impossible to move any farther



—From *Arctic Exploration*, by E. K. Kane, Childs & Peterson, Publishers, Philadelphia, Pa., 1857.

north. They discovered that the temperature was much more moderate than farther south—marine birds were observed, flowers grew on the barren and rocky coast.

Several parties which Dr. Kane sent forth returned, and the season for arctic travel—that is the winter—terminated. The members of the expedition were about to return to winter quarters; however, before doing this Dr. Kane resolved to attempt to reach Beechey Island where Sir Edward Belcher's squadron was supposed to be stationed. The party reached a distance of some 10 miles from Cape Parry on 31 July, but was confronted with a solid mass of polar ice, so that they were compelled to return. They reached their brig on the first of August without accident but without supplies, and found the *Advance* wedged

in the ice as tightly as it was 11 months earlier. So on 24 August it became necessary to decide whether to attempt to spend another winter in the Arctic or to attempt an escape. Neither was inviting. Commander Kane summoned all hands to a general consultation, stated the considerations involved, and how an attempt to escape by open water would be both dangerous and unsuccessful. He allowed the men to make the decision for themselves, and roll was called.

Eight of the seventeen decided to remain on the brig. To those who decided to leave immediately, Dr. Kane allotted their due portion of provisions, and also gave written assurance that should they be driven back they would receive a hearty welcome. They left on 28 August, but long before the remaining members of the expedition completed their preparations for abandoning the vessel overland in December, they all returned again to the vessel.

During the third and last winter which Dr. Kane was destined to spend in the Arctic regions, a great deal occurred, some cheering, some disheartening. Occasionally in the search for food a bear, walrus, or a seal was caught. The majority of the men became afflicted with disease, almost entirely due to lack of vitamin C. With the approach of spring his attention was directed toward the preparations for escape. The manufacture of clothing was an important part of this. Boots were made of carpeting with soles of hide, body clothing made out of blankets, sleeping sacks from buffalo robes, and provision bags made water impervious with tar and pitch. Ship bread was pounded into a powder and pressed into bags. Pork fat was melted down and molded in bags, as was cooked bean soup. Three boats were prepared for the party, the largest 26 feet long and 7 feet abeam. Each craft was single-masted and was mounted on sledges for the purpose of conveying them over ice when navigation was impossible. On Sunday, 17 May, after the Commander read prayers and a chapter of the Bible, the party hoisted and hauled down its flags, walked several times around the vessel, and began their journey out.

At length, after having to abandon one of their vessels, they reached, on 5 August, the port of Upernavik and there the memorable perils and sufferings of the expedition happily ended. The party returned to New York with the squadron of Captain Hartstene on 11 October 1855, having been absent for a period of 2 years and 9 months.

The official report which Dr. Kane rendered to the Secretary of the Navy displays a great deal of both scientific and literary skill. It is interesting to quote some pages from this report :

As we were about to winter higher north than any previous expedition, and besides a probable excess of cold, were about to experience a longer deprivation of solar light, the arrangements for the interior were studied carefully. The deck was housed in with boards and calked with oakum. A system of warmth and ventilation was established; our permanent lamps were cased with chimneys, to

prevent the accumulation of smoke; cooking, ice-melting, and washing arrangements were minutely cared for; the dogs were kennelled in squads, and they were allowed the alternate use of snowhouses and of the brig, as their condition might require. Our domestic system was organized with the most exact attention to cleanliness, exercise, recreation, and withal to fixed routine. During the winter which followed, the sun was one hundred and twenty days below the horizon and owing to a range of hills towards our southern meridian, the maximum darkness was not relieved by apparent twilight even at noon day. The atmospheric temperatures were lower than any that had been recorded by others before us. We had adopted every precaution to secure accuracy in these observations, and the indications of our numerous thermometers—alcoholic, ethereal, and mercurial—were registered hourly. From them it appears that the mean annual temperature of Rensselaer Harbor, as we named our winter-home, is lower than that of Melville Island, as recorded by Parry, by two degrees. In certain sheltered positions, the process of freezing was unintermitted for any consecutive twenty-four hours throughout the year. The lowest temperature was observed in February, when the mean of eight instruments indicated minus 70° Fahrenheit. Chloroform froze; the essential oils of sassafras, juniper, cubebs, and wintergreen were resolved into mixed solid and liquid; and on the morning of February 24 we witnessed chloric ether congealed for the first time by a natural temperature.

Our preparations for the second winter were modified largely by controlling circumstances. The physical energies of the party had sensibly declined. Our resources were diminished. We had but fifty gallons of oil saved from our summer's seal-hunt. We were scant of fuel; and our food, which now consisted only of the ordinary marine stores, was by no means suited to repel scurvy. Our molasses was reduced to forty gallons, and our dried fruits seemed to have lost their efficiency. A single apartment was bulkheaded off amidships as a dormitory and abiding-room for our entire party, and a moss envelope, cut with difficulty from the frozen cliffs, made to enclose it like a wall. A similar casing was placed over our deck and a small tunnelled entry—the tossut of the Esquimaux—contrived to enter from below. We adopted as nearly as we could the habits of the natives, burning lamps for heat, dressing in fox-skin clothing, and relying for our daily supplies on the success of organized hunting-parties.

The upper tribes of these Esquimaux had their nearest winter settlement at a spot distant, by dog-journey, about seventy-five miles. We entered into regular communication with this rude and simple-minded people, combining our efforts with theirs for mutual support and interchanging numerous friendly offices. Bear-meat, seal, walrus, fox, and ptarmigan, were our supplies. They were eaten raw, with a rigorous attention to their impartial distribution. With the dark months, however, these supplies became very scanty. The exertions of our best hunters were unavailing, and my personal attempts to reach the Esquimaux failed less on account of the cold (minus 52°) than the ruggedness of the ice, the extreme darkness, and the renewal of tetanic diseases among our dogs. Our poor neighbors, however, fared worse than ourselves: famine, attended by frightful forms of disease, reduced them to the lowest stages of misery and emaciation. Our own party was gradually disabled. Mr. Brooks and Mr. Wilson, both of whom had lost toes by amputation, manifested symptoms of a grave character. William Morton was severely frozen; and we were deprived of the valuable services of the surgeon by the effects of a frost-bite which rendered it necessary for him to submit to amputation. Scurvy with varying phases gradually pervaded our company, until Mr. Bonsall and myself only remained able to attend upon the sick and carry on the daily work of the ship, if that name could still appropriately designate the burrow which we inhabited. Even after this state of things had begun to

improve, the demoralizing effects of a continued debility and seemingly hopeless privation were unfavorably apparent among some of the party. I pass from this topic with the single remark that our ultimate escape would have been hazarded, but for the often painfully-enforced routine which the more experienced among us felt the necessity of adhering to rigorously under all circumstances.

In the latter part of March the walrus again made their appearance among the broken ice to the south, and we shared with the Esquimaux the proceeds of the hunt. The hemorrhages which had much depressed our party subsided, and we began slowly to recover our strength. The sun came back to us on the 21st day of February; and by the 18th of April the carpenter and several others were able to resume their duties.

It is interesting to note that Commander Kane, as did John Rae years before, deviated from the custom of avoiding the native habits. His comments in the report which is quoted reveal the apparent effectiveness of fresh meat in overcoming the effects of scurvey.

Kane's report has another interesting discussion on his attempts to live off the land. Tradition had before, and still has, made the arctic inhospitable and barren, in spite of Stefansson's remarkable experiences described in the "Friendly Arctic" and "My Life with the Eskimo" when he lived native style in the Arctic, much of the time hunting and fishing and maintaining himself without the use of white man's supplies. The results of Dr. Kane's second expedition, although he did not find any remnants of the lost Franklin expedition, merit highest praise and admiration. Dr. Kane explored the northern part of Greenland, and much of his charting still is valid. He discovered and studied the Great Humboldt Glacier. He demonstrated the capacity of adequately trained white persons to live off the land in the Arctic. He delineated nearly a thousand miles of coastline. The most singular finding of Dr. Kane's expedition, discovery of the open Polar Seas, was ironically won by Mr. Morton.

Dr. Kane's health was much impaired on his return from the second expedition. In spite of his ailing health, he sailed to England in 1856 where he visited with the devoted wife of Sir John Franklin, and where he was accorded honor and distinction for his arctic efforts. His heart disease troubled him greatly, and so he sailed for Cuba in an effort to recuperate. A few days after he reached Havana on Christmas 1856 he began to sink rapidly. On 16 February 1857 he died.

It is somewhat ironical that one of our Navy's earliest and most exacting arctic explorers has not been given his proper niche in our naval histories.

Dr. Kane, by his example, showed that man can survive in the Arctic with ingenuity and skill, and with understanding of the Arctic, and he showed too that the tradition that Arctic living demanded supreme physical strength is fallacious. Perhaps the best praise we can give him is to perpetuate naval tradition in the research and exploration of the Arctic.

THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



BOOK REVIEW NUMBER OF THE UNITED STATES NAVAL MEDICAL BULLETIN

The section of the BULLETIN devoted to book notices has been in existence for 40 years, and it has rendered a most useful service in that time in supplying information on new books on medicine, surgery, dentistry, pharmacy, and nursing to officers of the Medical Department. This is the first time in the history of the BULLETIN that a special number has been devoted to book reviews.

The extension of space devoted to new books in this issue is for several reasons. In the first place, during the war years, there was a lack of paper and printing facilities. In the second place there was a lack of authors as so many medical men were in the armed services and engaged in the war. Finally, there was the feeling that new developments were occurring so fast, and their evaluation so difficult, that it would be in the relatively more static period after the war that these developments would be properly weighed and recorded.

Now that the conflict is over, these anticipations are being realized. Paper and presses are again being available. Most important of all the authors are again appearing, eager to pour out the lessons learned during the war period, much of it unrecorded or only recorded in the periodical literature of many countries.

Books in the medical and allied fields are now appearing in considerable numbers, not only in this country but abroad. At the recent meeting of the American Medical Association at Atlantic City, the exhibits of the great medical book publishers were full of attractively printed, well illustrated books. Notices and reviews are given in this number of the BULLETIN of many new books and a number of others are listed with sometimes only a brief note. An effort has been made, however, to present the names of as many new books to readers of the BULLETIN as possible as a guide to the personal purchase, requi-

sition for official libraries, or to draw the attention to the many new and valuable books now appearing of interest to physicians, dentists, pharmacists, nurses, and to workers in the sciences allied to medicine, such as psychology, biology, biochemistry, and similar subjects.



A NEW APPROACH TO THE VENEREAL DISEASE PROBLEM

The rates for venereal disease are usually given in parts per thousand per year; thus, a rate of 100 per thousand would indicate 100 admissions for venereal disease among 1,000 men in a year. This, however, does not necessarily mean that 100 men out of 1,000 had venereal disease during a year. It might mean that 50 men had venereal disease twice or 10 men 10 times, which is a very much different picture than usually arises in the mind when the expression 100 per 1,000 is used.

It is of interest that if a large group of men, say 100 for example, of a crew of a ship were taken and their records for venereal disease examined for a period of 4 years, it would be found usually that about 75 percent have no admission for any venereal disease. About 5 or 10 percent have had several admissions and another group of about 10 or 15 percent have had one admission. As a result it would be found that the small group, 5 or 10 percent, from a statistical standpoint have produced most of the records of venereal infection in the community or among the thousand involved. As one medical officer put it, 10 percent of the group produced 90 percent of the venereal disease. This small group might aptly be termed "venereal addicts."

Efforts aimed at this small group would seem to hold the greatest promise of bringing about any considerable reduction in the venereal rate of the Navy.

As these men had contracted venereal disease more than once in spite of all the additional physical and chemical methods of prophylaxis, intensification of this program is not likely to produce any marked results. A new method, however, is open by the elimination through a discharge of men who have had a venereal infection two or more times in the first 3 years of their enlistment. This separation from

the service would be under honorable conditions and would not be a punishment for misconduct but simply because the man is a liability to the Navy. By reducing, however, the number of this small group a distinct reduction in the incidence of the Navy would result.



FALLACIES AND FACTS IN REGARD TO SWIMMING

One of the most common fallacies is that people should be taught to swim to lessen their chance of drowning. The fact is that the death rate from drowning is greater among swimmers than nonswimmers, and therefore as soon as a person learns to swim his or her chances of death by drowning are increased and not lessened.

This seeming paradox is of course due to the fact that the person who can swim indulges in swimming as a sport and is exposed to the hazards of drowning. The nonswimmer ordinarily does not go near the water and drowning is limited to accidents such as falling off a dock or vessel.

It is true that in certain occupations such as that of the sailor, dock worker, and some others, it is desirable to know how to swim, for here the person's regular work and mode of life expose him to the danger of drowning. Furthermore, swimming is a sport which affords pleasure and that is a good reason for learning to swim. But to recommend the teaching of swimming on the basis of lessening ones chances of drowning is definitely unsound.

There are many healthful features connected with swimming. There are also a great many serious and painful diseases incident to it. Again, unfortunately, the healthful effects are stressed and the unhealthful ones go unmentioned. It is possible that there are commercial reasons for this, for like many other sports swimming is big business. It is a major attraction at seaside resorts, and the manufacture and sale of swimming clothing and accessories are important commercial fields. Swimming, however, is a problem involving both life and health, and people are entitled to know the facts. The medical profession knows these facts and should disseminate them and controvert the fallacies.



THE FREQUENCY OF SYPHILIS AND GONORRHEA AS CONCURRENT DISEASES

The use of penicillin in the rapid treatment of gonococcus infection has again drawn attention to a new danger. This is the fact that the cure of gonorrhea may be brought about by a dosage of penicillin which will prevent the characteristic signs and symptoms of syphilis from appearing but in no way cure it. Thus, the more serious disease is merely masked by the treatment of the gonococcus infection and serious damage may be done before the lesions of syphilis become apparent.

The United States Public Health Service, in their study of cases at the rapid treatment centers, found that about 9 percent of cases there were infected with both diseases. There is need, therefore, to be on the alert when penicillin particularly is used in the treatment of gonococcus infection, that a thorough search be made for signs of syphilis, and serological tests and other examination repeated later for evidence of the disease.



ALCOHOLISM

The high incidence of alcoholism in this country and its association with crime and with automobile and industrial accidents presents a most serious social problem. The ramifications go into every branch of society, and the courts, the legislative bodies, our hospitals, and penal and correctional institutions are all affected. It has most important economic effects.

There have been many attempts to solve the problem, none of which has been very successful. Legal restrictions leave much to be desired and are difficult to be enforced in this country without wholehearted public approval. In recent years an attempt to classify alcohol as a disease has had support from some psychiatrists and from some social agencies and groups, official and unofficial.

It is of interest that in the annual report of the alcoholic clinic maintained by New York City the idea that alcohol is a disease is definitely rejected. Indeed the concept that he is "sick" is regarded as harmful to the alcoholic and interferes rather than assists attempts at rehabilitation.

Basically, it remains a matter of individual conduct. If a person takes alcohol in small quantities and principally with foods, and has the necessary personality stability to do this without injury to himself and others no harm is apparently done. But if the bounds of such

moderation are passed, conflicts with himself and society occur that take a heavy toll in life, suffering, and money. In reality alcoholism is not only a medical problem and cannot be solved by medical treatment alone. Many parts of our modern society must cooperate in dealing with it. Broad and unprejudiced studies, carefully planned programs, and earnest effort by medicine, the legal profession, the churches, and Government, are necessary in any effort to reach a real solution.

CLINICAL NOTES



ACUTE HEMOLYTIC ANEMIA FOLLOWING THE INTRA-PERITONEAL ADMINISTRATION OF SULFANILAMIDE

REPORT OF A CASE

HOWARD A. JOHNSON

Commander (MC) U. S. N. R.

Long experience has taught that justification for administering powerful drugs exists only in the presence of definite clinical indications. Indiscriminate use of sulfanilamides violates that principle, and offers the patient less than reasonable chance of benefit while subjecting him to the risk of dangerous reactions. The following case history is an example.

CASE REPORT

In the late afternoon of 21 March 1946 an 18-year-old apprentice seaman was admitted with symptoms and signs characteristic of acute appendicitis. Well until noon the previous day, his illness began with abdominal cramps and nausea. The pain was gradual in onset, became increasingly severe, and several hours later, "settled in the right side." Constipation had been present several days. There were no disturbances referable to other systems and his past medical history was not significant.

Physical examination was negative except for the patient's moderately ill appearance and well localized tenderness over McBurney's area. His temperature was 101.2° F., pulse rate 84, and respiratory rate 20.

There was moderate leukocytosis, white blood cells 18,700. Urinalysis was normal.

At immediate operation under spinal (procaine) anesthesia, an acutely inflamed (suppurative) appendix was removed through a right gridiron incision. Moderate difficulty was experienced and the procedure required more than usual manipulation. Consequently 3 grams of sulfanilamide crystals were placed in the stump area, though no gross contamination or infection of the peritoneum was evident. The wound was closed without drainage.

On the following morning the patient felt only fairly well. His temperature, pulse, and respirations were 99, 84, and 16 respectively. Later in the day he complained of malaise, nausea, weakness, and mild throat soreness and by the second morning those symptoms were pronounced. Scleral icterus was noted, but physical examination was otherwise negative. His temperature, pulse, and respirations were normal and urinalysis showed no change.

The third day his jaundice was increased and bile was present in the urine. The patient was extremely nauseated and vomited several times. He appeared distinctly ill.

By the following day the vomiting had ceased and he could retain small amounts of nourishing fluids. However, he showed definite pallor. The urine continued to show bile, the icterus index was 22, blood hemoglobin was 65 percent (9.5 grams) and the red blood count 3,100,000. Blood sulfanilamide determination revealed a trace. (The use of sulfanilamide had been limited to the intraperitoneal dosage.)

The fifth day he appeared improved although his temperature rose for the first time, reading 101.2° F. that evening. He had a mild episode of epistaxis the same day. The next day the patient complained of weakness. He had pronounced pallor, but fever was minimal and the pulse rate 80. A second mild attack of epistaxis occurred. The hemoglobin was 41 percent, red blood count 2,100,000, white blood count 11,600 (juveniles 3 percent, bands 19 percent, segmented forms 53 percent, lymphocytes 16 percent, eosinophiles, 1 percent, monocytes 8 percent), and platelets 327,000. After operation no drugs capable of producing hemolysis had been given. Treatment had been symptomatic and had consisted principally of 1,000 cc. of dextrose in normal saline intravenously, twice a day. At this point a transfusion of 500 cc. of whole citrated blood was administered.

During the ensuing few days, the patient showed prompt improvement. The icterus cleared, and the red blood count rose. The results of subsequent studies were within normal limits. Soon active about the ward, he was discharged to duty fully recovered on the 29th day.

COMMENT

Sulfanilamide appeared to be the only possible cause of the symptoms in this case because (1) no other drug capable of producing hemolysis had been administered; (2) secondary hemorrhage as a factor could be eliminated by the absence of abdominal signs or symptoms and of significant changes in the pulse, blood pressure, and blood leukocyte count; and (3) infectious hepatitis could be ruled out by the abrupt onset of the illness, the marked anemia, and the absence of chills, fever, and other characteristic symptoms and signs such as tenderness or enlargement of the liver.

Acute hemolytic anemia can result from sulfanilamide therapy (1) (2) (3) (4). At least two such cases caused by the intraperitoneal application of this drug have been previously reported (15) (16). Although it is an uncommon complication, considering the wide use of this accepted procedure (7) (8) (9) (10), the possibility of its occurrence should be fully considered.

Hobart Amory Hare said, "Any drug which is powerful to do good is powerful to do harm." Nothing today seriously disputes that axiom. Therefore, the decision to use a powerful drug should depend upon adequate consideration of these questions: (1) What are the indications? (2) What are the contraindications? (3) Is employment of the drug clearly justified in this instance? Sulfanilamide is a potent agent and cannot be an exception to that principle.

Recovery from the appendectomy, per se, in the case cited was uncomplicated. In the absence of definite infection, sulfanilamide was probably not essential, but was used merely as "an added precaution"

to prevent peritonitis. "An added precaution" hardly satisfies the aforementioned criteria for the administration of a potent drug. Consequently, the use of sulfanilamide in this instance was hardly justified.

SUMMARY AND CONCLUSION

1. A case of acute hemolytic anemia following topical application of sulfanilamide in the peritoneal cavity is presented.
2. An established principle in the use of potent drugs is reviewed.
3. The advisability of intraperitoneal administration of sulfanilamides in patients without definite peritoneal infection is again disputed (6).
4. Adequate indications are necessary to justify the use of potent drugs including the sulfanilamides.

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RECONSTRUCTION OF THE THUMB¹

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Defects of the thumb from infection or injury, whether complete or partial, produce marked loss of hand function. Whenever possible, tissue should be replaced instead of amputating further to secure a satisfactory flap to cover lost tissue. Soft tissue losses of the terminal phalanx can be quickly repaired by means of a one stage tubed abdominal flap to restore the thumb contour (1).

The sense of touch is usually restored in a few months. Where there is a loss of one or both phalanges the thumb may be restored by means of a delayed abdominal tube grown to the amputated stump. Rigidity of the tube is accomplished by means of an intramedullary bone graft to the remaining phalanx or metacarpal bone according to the degree of bone loss.

To secure a satisfactory restoration in case of loss of both the phalanges it is necessary to have sufficient amount of the metacarpal remaining to permit free movement of the stump. It is possible to secure some use from a rigid thumb but the results are of the prehensile type.

Many methods have been described for restoration of the thumb. These are phalangization, prosthesis, rotary angulatory osteotomy, tubular pedicle graft with inserted bone graft, transplantation of the index finger to position of the thumb and digital transplantation from either the hand or the foot. All these methods have their uses and advantages.

In the case described below the tubular pedicled graft with inserted bone graft was used. This method may be applied to a loss of one or both phalanges of the thumb or up to a two-thirds loss of the metacarpal bone.

CASE REPORT

H. P. L., a 35-year-old machinist mate, was injured on Kwajalein Island on 18 June 1945 while operating a power saw. His hand slipped into the cutter as it hit a knot in the lumber, resulting in amputation of the first and second fingers of his left hand. He received emergency and definitive treatment after which he was evacuated to the mainland. On admission to this hospital the following pertinent findings were noted: The first and second fingers had been amputated, the second metacarpal had been removed cleanly at its distal one-third, and the first metacarpal had been amputated cleanly proximal to the metacarpal-phalangeal joint.

¹ From the Department of Plastic Surgery, U. S. Naval Hospital, Great Lakes, Ill.

The soft tissue covers both stumps nicely. The fingers remaining are flexible, and the first metacarpal stump moves well in all directions. This stump is ideal for grafting a new thumb.²

On 17 December 1945 a pedicle tube was raised on the right side of the abdomen. The tube measured about 6 inches between its attached ends and 1 inch in diameter. The tube healed well; elevated one-half on its medial end on 7 January 1946.

On 19 January 1946 the pedicle tube was again undermined one-half at its distal end. The wound healed primarily.

On 28 January 1946 the pedicle tube



FIGURE 2.—A pedicle tube has been raised on the right side of the abdomen.

hand was dressed and held in position by adhesive tape strips. The tube grew well to the stump of the thumb; sutures were removed 12 days later.

On 18 February 1946 the pedicle tube was completely detached from its abdominal attachments. The site selected for severing the tube was about



FIGURE 1.—Loss of first and second fingers, left hand. Amputation resulted from operating a power saw. Two-thirds of first metacarpal bone left. This will be used as a base for a new thumb.

was completely detached from its distal attachment by incising the previously outlined flap down to the previous incision. The donor area on the abdomen was undermined around its margins sufficient to close the wound primarily. The left hand was brought up to the flap, and the flap margins marked out on the thumb base.

An area was prepared for the attachment to the pedicle measuring $1\frac{1}{2}$ inches in all directions. The pedicle tube was attached in line of what was intended to be a new thumb. The



FIGURE 3.—The lower end of the pedicle tube has been detached and sutured into position to form the base of the new thumb.

² When it was first decided to reconstruct this thumb it was noted that two-thirds of the first metacarpal bone remained intact. The metacarpal bone was freely movable in all directions by means of its tendon attachments. This metacarpal bone served as a base for the bone peg inserted in the medullary canal. No tendons were inserted in the new thumb. All motion abduction, adduction, and rotation occurs in the metacarpal bone with its tendon attachments. Hence, the thumb moves freely in all directions on its metacarpal base.



FIGURE 4.—The pedicle tube has been detached and trimmed. Three months have elapsed. Ready for bone graft.

1 inch longer than was desired for the length of the thumb to allow for shrinkage. The skin at the end of the tube was sutured and the abdominal stump was revised and trimmed. The pedicle tube healed well and the sutures were removed after 6 days. Three months elapsed before the pedicle tube was ready for a bone graft.

On 25 May 1946 a bone graft consisting of the thickness of the rib, 3 inches in length, was removed from the anterior end of the twelfth rib. The bone graft was shaped at its large end to fit the medullary canal of the metacarpal bone with the peg end measuring

1/4 by 1 1/2 inches. A portion of the cartilaginous end of the graft was removed. An incision was made in the pedicle tube exposing the center and extending from the end of the metacarpal to within 1/2 inch of the tip. With an oral burr in the electric drill the end of the metacarpal bone was squared and the medullary canal drilled so the bone graft fitted snugly. The curve of the graft was made downward and inward. The graft was placed in the center of the tube and closed with routine sutures. A plaster cast was applied. The plaster cast was removed on the seventh day and sutures removed from the wound.

The wound healed by primary intention and a new cast was applied. The cast was removed 6 weeks later and x-ray of the bone graft showed excellent healing.

The thumb, on removing the cast at the end of 10 weeks, indicated complete healing and firm fixation of the bone peg. At the end of 3 months the patient was able to approximate the new thumb and the third finger.



FIGURE 5.—X-ray of hand shows bone graft in position. The bone peg is firmly secured in the medullary canal of the first metacarpal bone. Fifty-four days since bone graft was inserted.

The patient has been discharged from the service and on latest reports has been using the new thumb while engaged in carpenter work and brick laying. He has almost complete return of sensation over the entire thumb.

SUMMARY

Small tissue defects of the thumb produce marked disability of the hand. These can be repaired quickly by means of a one stage abdominal pedicle tube.



FIGURE 7.—The new thumb is mobile at the metacarpal carpal joint. The patient is able to approximate the new thumb and the third finger. He can pick up small objects and finds the new digit extremely useful.

Larger defects, including loss of phalanges and up to two-thirds of the metacarpal bone may be satisfactorily repaired by means of a delayed tubular abdominal pedicle graft with inserted bone graft.

A case report of a restoration of the thumb has been presented.

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FIGURE 6.—Final result; thumb in adduction.



FIGURE 8.—The new thumb in abduction.

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INTESTINAL PERFORATION RESULTING FROM ATMOSPHERIC BLAST

HAROLD FINK

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The rapid dissipation of pressure due to blast in air as contrasted to the rate of diminution in water is due to the density and consequent incompressibility of the latter medium (1). Thus an impulse from a given charge in water will be transmitted further and at any given distance the effects will be more damaging than those sustained in air. Zuckerman (2) has noted that for a 125-pound charge in air the pressure at 15 feet is 200 pounds per square inch, while at 50 feet, about 10 pounds per square inch; in each instance above the normal atmospheric pressure of 15 pounds per square inch. Figures for the same charge under water are not available but Greaves et al. (3) have shown for a charge of 300 pounds under water at 174 feet, the pressure is 500 pounds per square inch, at 100 feet 871 pounds, and at 50 feet 1,740 pounds per square inch. These sharp differences in resulting pressures are reflected in the injuries sustained in exposure to atmospheric blast as contrasted with immersion blast.

The relative frequency of intestinal perforation due to immersion blast has been noted (4) (5) (6) (7) (8) (9) (10). Experimental animals subjected to immersion blast have shown such lesions (11) (3) (1). A review of the literature indicates its rarity, however, in atmospheric blast. Breden, d'Abreu and King (9) have described a series of patients who were subject to blast at sea. Of these, one was not in water but in an enclosed space aboard ship when the detonation occurred. In addition to pulmonary hemorrhages, he presented a perforation of the small bowel 3 feet from the ileocecal valve. Death followed from peritonitis.

O'Reilly and Gloyne (12) have noted evidence of intra-abdominal injury in atmospheric blast. Two of their cases showed subserosal hematomas but no bowel perforations were noted.

A case of intestinal perforation from atmospheric blast is presented because of its infrequency.

CASE REPORT

History.—A young white male age 20 years 10 months, GM 3/c, member of an Armed Guard Crew, was topside at his duty station aboard a merchant ship in subtropical waters when the vessel was struck by a torpedo. While running forward along a catwalk, a second explosion occurred which threw him to the walk. When picked up by his shipmates, he declared that with the explosion he felt as though "something tore in him." He was very weak and was helped over the side of the ship and put on a raft. No other explosions occurred. Within an hour the survivors were picked up. A half hour later, the sailor died.

Autopsy findings.—Autopsy 48 hours after death revealed the following significant findings: The skin of both shoulders and upper extremities showed innumerable pitted fresh, superficial punched-out ulcers measuring 2-3 mm. by 1 mm. in depth. They resembled a defect that might be made by a small skin curet or biopsy punch. The pleural cavities each contained 100 cc. of sanguineous fluid. No free fluid was present in the pericardial or peritoneal cavities. The lungs were well expanded. The visceral pleura was smooth and glistening except for scattered pea-sized hemorrhages whose relationship to rib and rib-interspace was not demonstrable. The trachea and bronchi were filled with an abundant pink frothy fluid. The lungs on section were well aerated throughout. Scattered small hemorrhagic areas 2-3 mm. in diameter were noted. The heart was average.

The abdomen was moderately distended. On opening the peritoneal cavity there was a rush of foul-smelling gas. There was no distention of the loops of bowel. The organs lay in average relationship. The right leaf of the diaphragm was at the fifth rib and the left leaf at the sixth rib. The liver was intact except for faint nutmegging. Spleen and pancreas were normal. The medullae of both adrenals were completely autolyzed. Kidneys showed nothing unusual except for the glomeruli which stood out as bright red pin points. The remainder of the genito-urinary tract was normal. Several sessile papilloma were present on the glans penis.

The intestinal tract to the mid jejunum was intact. From this point to the ileocecal valve were nine perforations. These varied from a longitudinal slit 1 cm. in length to an oval pouting defect 1.5 by 0.5 cm. In most, the edges were everted and in two instances the edges had a heaped-up appearance. The adjacent wall showed variable amounts of hemorrhage. In this area of the bowel were scattered subserosal hemorrhages from 0.5 cm. in diameter to 2.5 by 1 cm. In the left lateral peritoneal gutter there was some fecal material. No inflammatory reaction was present.

Examination of the head showed no lacerations or hematomas of the scalp. There was no fracture of the vault or base of the skull. The dural venous sinuses were intact. The brain was grossly normal except for slight engorgement of the cerebral vessels. The right lateral ventricle was slightly dilated and filled with clear fluid. Pituitary gland was average. Serial section showed no gross hemorrhages.

Histopathological findings were as follows:

Brain: Sections from cortex, basal nuclei and medullary areas showed marked capillary engorgement with prominent perivascular lymph spaces. Scattered areas of extravascular erythrocytes were present in the cortex. One such area presented a remnant of endothelium in one aspect. The parenchyma adjacent to the hemorrhages was edematous with loss of cell definition. Marked engorgement was noted in the cerebellar and meningeal vessels.

Lung: There were scattered areas of extreme engorgement of alveolar wall capillaries. The enclosed alveoli were often filled with erythrocytes. In areas the hemorrhage was diffuse and obscured the septal structures. The bronchioles were empty. There was no inflammatory reaction. A minimal anthracosis was noted.

Liver: There was some loss of cell clarity throughout, due to post-mortem change. The central veins of the lobules were engorged. There were some scattered parenchymal hemorrhagic areas not related to the portal spaces or central veins. Portal space structures were average. A few portal spaces showed an accumulation of lymphocytes.

Intestine: One section of small bowel showed an irregular area of hemorrhage throughout the submucosa. One vessel showed marked engorgement with areas of extravascular erythrocytes in the adventitia. A section taken through one of the perforations presented an irregular hemorrhage through all layers with loss of underlying cellular detail. No inflammatory reaction was present.

Sections of other organs showed no pertinent histologic changes.

DISCUSSION

Blast is defined (2) as the compression and suction wave which is set up by the detonation of high explosive. The waves extend in all directions. The mechanism of propulsion of the wave is similar to that of sound. The disturbance moves, but the individual particles of the medium oscillate to and fro over equilibrium positions (13). The oscillations are in the line of propagation, hence are longitudinal waves. Sound waves (and blast wave is an excessively intense sound wave) are longitudinal. The second component of the blast is the rarefied zone that follows the compression wave. This phase gives rise to pressures less than atmospheric. It tends to, but does not, reach a vacuum.

The action of the blast wave on impact against an obstacle in its course is that of transmission of the impulses to the particles of the object. Thus, if the second medium is glass, the amplitude of vibration may lead to an immediate shattering of the glass, or if a brick wall, this vibration may lead to weakening and ultimate collapse. If the new medium be a gas enclosed in a space, it is first compressed proportional to the degree of pressure and following the suction phase, re-expanded. Compression phases have been shown to reflect when striking another medium. Thus Greaves (3) has shown that when a pressure of 500 pounds per square inch strikes the surface of water, it tends to "blow off" or shred the surface.

One might compare the pressures exerted by the force of blast with comparable pressures obtained in deep-sea diving. Table 1 from Davis (14) with interpolations from Zuckerman, Greaves, and others will illustrate this.

TABLE 1

Depth of salt water in feet	Remarks	Positive pressure (lb. per sq. in.)	Absolute pressure ¹ in atmospheres
0	Surface	0	1
1		.44	
2½		1	1
33		14.7	2
66		29.4	3
99		44	4
133		58.8	5
300	Present limit of dress diving	133.3	10
400	Deepest salvage "Egypt"	177	12
1,131	300-lb. charge at 174-ft. distance in water	500	35
3,950	Same at 50 ft	1,740	119
454	125-lb. charge at 15 ft. in air	200	14.6
22.7	Same at 50 ft	10	1.7

¹ Absolute pressure is equal to positive pressure plus pressure of the column of air above the water, or 1 atmosphere at 14.7 lb. per square inch. For every 33 feet descent, the pressure increases 1 atmosphere. At the summit of Mount Everest (29,140 ft. above sea level) the pressure is 4.6 lb. per square inch, or 0.31 atmosphere.

In immersion blast the pressures involved in the exposure to a 300-pound charge at 174 feet would affect the gases in the body in a similar manner to that of descending to and rising from 1,131 feet below the surface of the sea to several thousand feet above sea level in less than 1 second. The suction phase which is less than atmospheric pressure would represent this rise in the rarefied pressure of high elevations. The duration of the wave for a 70-pound charge has been calculated by Zuckerman (8) as 0.006 second for the compression phase and 0.03 second for the suction phase.

The range of pressure changes in air and water may be seen in figure 1. The contrast in the two media is manifest. For comparable pathology to ensue, the victim in air must be within a radius of 15 feet of the explosion. The statistics of intestinal perforation bear out this statement. In the deaths from blast in the "blitz" in London (15), deaths were due to pulmonary hemorrhage, shock, compression injuries, and carbon monoxide asphyxia with notable absence of intra-abdominal lesions.

SUMMARY

1. A case of intestinal perforation due to atmospheric blast is presented.
2. The marked differences in the force of comparable blast charges at varying distances in air and in water are noted.

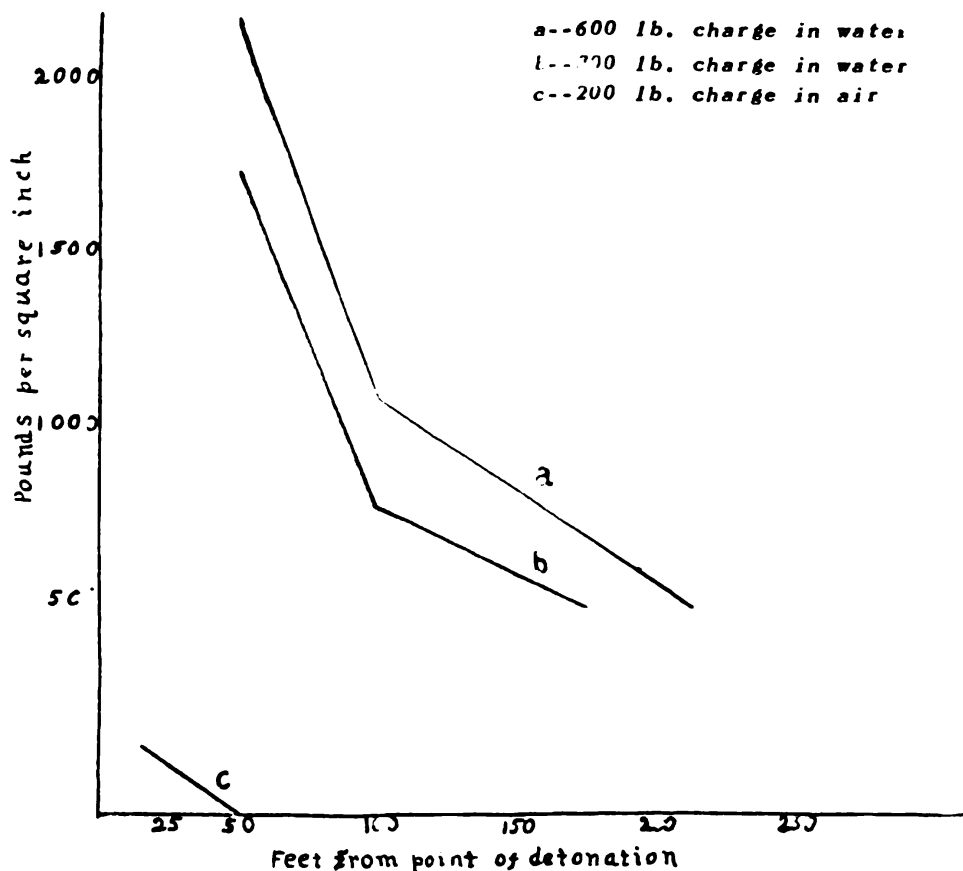


FIGURE 1.

3. The effects of blast are compared to the effect on body gases by the descent to sea depths of from 400 to 4,000 feet and ascent to high altitudes within a period of less than 0.04 second.

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INFECTIOUS MONONUCLEOSIS

REPORT OF CASE IN A NEGRO

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Infectious mononucleosis is an acute contagious disease, protean in nature, whose only constant feature is an increase in the mononuclear elements of the blood and the presence of heterophile antibodies in the blood.

The disease occurs in sporadic and epidemic form, but in this country the usual cases seen are sporadic and in young adults. Wintrobe (1) pointed out in 1942 that only one case in the Negro has been described in literature (2). Since that time five other cases have been reported, two in children (3), and three in adults (4). It is suspected that it is not as rare in the Negro as has been assumed, but it is still far from common as reflected in Ray and Cecil's cases (4) where only three cases were found over a 4-year period in a hospital with a large Negro admission.

This case is presented because of the current interest in the subject and because it presents such a classical picture:

CASE REPORT

Three days prior to admission, E. D., 19-year-old Negro seaman, noticed enlarged cervical lymph nodes, not painful or tender. On admission, 10 July

1945, he complained of sore throat, painful cervical nodes, headache, and anorexia. Systemic review otherwise negative.

Past Medical History.—Mumps 1 year previously in 1943, gonorrheal urethritis 1 month ago treated with penicillin. Denies history of penile lesion.

Family History.—Father, mother, and 12 siblings living and well.

Physical examination.—Well-nourished young male Negro, oriented, cooperative, does not appear acutely ill. Skin normal, no rash. Temperature 99.4° F., pulse rate 80, and respiration 18.

Lymph Nodes: Cervical nodes grossly enlarged, firm, not confluent, moderately tender. Posterior cervical, axillary and inguinal nodes show shotty enlargement, only slightly tender. Epitrochlear nodes not palpable.

Head: Normal.

Ears, eyes, nose: Slight congestion nasal mucosa, right tympanus injected along handle of malleus.

Throat: Tonsils considerably enlarged, red, smooth and glistening with no exudate or membrane.

Heart and lungs: Normal.

Abdomen: Soft, flat, no tenderness, no masses.

Extremities: Reflexes normal.

Laboratory Data.—Red blood cells 4.75 million, hemoglobin 80 percent, white blood cells 8,500, polymorphonuclear leukocytes 29 percent, lymphocytes 68 percent, monocytes 3 percent. Urine normal. Tuberculin test negative. Kahn negative, Heterophile antibody agglutination 1:112.

15 July: Temperature 103° F. Tonsils more edematous and follicular.

16 July: Temperature 103° F. Tonsils extremely swollen, meeting in middle and extending into the nasopharynx so that swallowing is quite painful. Sulfadiazine orally started. White blood cells 11,000, polymorphonuclear leukocytes 31 percent, lymphocytes 67 percent with numerous abnormal forms, monocytes 2 percent.

18 July: Temperature 102° F. Throat improving. White blood cells 16,000, polymorphonuclear leukocytes 22 percent, lymphocytes 69 percent, monocytes 2 percent, eosinophils 1 percent. Heterophile antibody agglutination 1:224. Kahn 2 plus.

22 July: Temperature 99° F. Throat much improved and cervical nodes receding somewhat. Spleen questionably palpable. White blood cells 6,800, lymphocytes 67 percent. Kahn strongly positive.

24 July: Temperature normal and no complaints. White blood cells 6,100, lymphocytes 55 percent.

29 July: Patient out of bed, cervical nodes easily palpable but no longer visible, other nodes no more than palpable. White blood cells 8,000, polymorphonuclear leukocytes 63 percent, lymphocytes 34 percent, monocytes 2 percent, eosinophils 1 percent. Heterophile agglutination 1:112, Kahn negative.

5 August: White blood cells 7,000, essentially normal differential. Kahn negative.

SUMMARY

1. Six cases of infectious mononucleosis in the Negro have been reported, five of them in the past year.

2. One additional case of infectious mononucleosis in a Negro is presented here.

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MEDICAL AND SURGICAL DEVICES



IMPROVED GUILLOTINE OPERATION AND RETRACTOR

CHARLES MRAZEK

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The guillotine type of operation is the one indicated by the results in World Wars I and II as the method to be used in war injuries requiring amputation.

Amputations may be elective or may be urgently necessary to save life. Elective amputations are indicated in clean, noninfected cases where the site, the circulation, and the remaining tissue permit a well planned surgical operation that ultimately fulfills the basic requirements of a good stump.

Emergency amputations are usually lifesaving and the guillotine or open operation, based on sound surgical principles of drainage of infection, should be performed. The operation is easily performed and a good stump having prosthetic efficiency is obtained more often in those cases where the site of amputation cannot be selected because of uncontrollable circumstances and type of injury encountered.

The more simple the operation the faster it can be performed. This maxim is of utmost importance in poor operative risks and in cases which readily go into secondary shock. Guillotine operations can be simplified by employing a circular plate muscle retractor (fig. 1). This instrument speeds the operation and avoids some of the most common postoperative complications. It can be used in either the guillotine or planned flap operation.

The retractor is an 8-inch circular, $\frac{3}{16}$ -inch thick plate with two riveted handles bent at right angle to the plate (fig. 2). A $1\frac{1}{2}$ -inch slot extends from center of the plate to its periphery. This plate is used for amputations of the lower extremities and will accommodate the thick long bones of the lower limbs. A proportionately small identical plate is used for amputations of the upper appendages. This smaller plate is 5 inches in diameter and has a $\frac{7}{8}$ -inch slot to accommodate the smaller diameter of the long bones of the upper limbs.

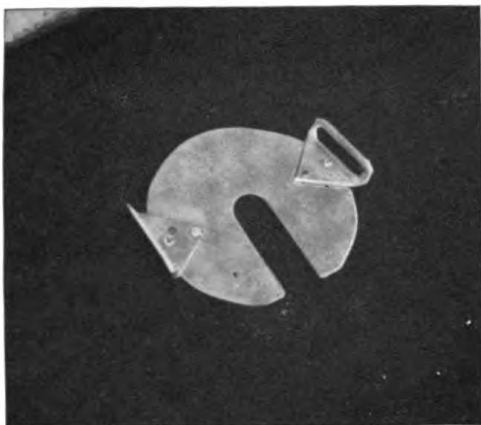


FIGURE 1.



FIGURE 2.

After shock is adequately treated, the next aim is to remove the undesirable mangled and infected portion of the extremity. Best results are obtained if a concave cross-section of the distal end of the limb is produced. This is accomplished with a circular skin incision at the lowest viable tissue site that will preserve length and produce an adequate stump for prosthesis. The fascia is incised in a similar manner but slightly more proximal to the skin incision. Underlying muscle is incised proximal to the fascia, thus producing a concave cross-section. With the aid of the circular, slotted muscle retractor, the bone is sawed off transversely 1 inch shorter than the cut retracted muscle. The bone is not treated and no periosteal cuff is removed.

Use of the circular muscle retractor avoids muscle mutilation and facilitates sawing of the bone, also helping to keep bone sawdust and periosteal shreds from disseminating into the muscle. Small bone particles adhering to the plate can be readily removed with sterile saline solution. Mutilated muscles injured by the saw may result in tissue sloughs; the bone particles cause infected osteophytes which delay healing and are the cause of painful stumps. In the experience of the author, cutting the bone 1 inch shorter than the cut retracted muscle avoids the common complication of a protruding bone, which requires another operation and results in loss of the stump length.

All the blood vessels are clamped and transfixed with 00 catgut. Small blood vessels are ligated individually. Nerves are severed and allowed to retract without any further treatment.

Most poor stumps are due to faulty surgery and postoperative care. Recommended postoperative care consists of light frosting of the wound with sulfathiazole and covering with vaseline-impregnated gauze. This is covered with a large-size dressing held in place by a ladder which encircles the distal end of the stump. The ladder is made of tongue blades, one-half inch apart, held together at both ends

with adhesive tape. No traction or elastic roller bandages are used except in cases of extreme muscle contraction. However, in war surgery where the treatment cannot be followed from beginning to end, the elastic roller bandage should be applied immediately to avoid bone protrusion.

SUMMARY

1. The guillotine operation is indicated in war wounds which necessitate an amputation. It saves lives and can easily be performed.
2. The muscle retractor allows the bone to be sawed off with ease 1 inch shorter than the incised muscle. This insures against, and avoids bone protrusion and subsequent unnecessary operations which result in added shortening of the stump.
3. Osteophytes and muscle mutilation is minimized, and complications are less frequently encountered.
4. Speed is enhanced.

ACKNOWLEDGMENT.—The skill of Lawrence B. Baker, SF2c, in manufacturing the demonstrated instrument is appreciated.

BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,

Washington 25, D. C.

(For review)

MUSICAL SONS OF AESCULAPIUS, by *Willard Marmelszadt, M. D.* Foreword by *Victor Robinson, M. D.* 112 pages; numerous illustrations. Froben Press, New York, N. Y., publishers, 1946. Price \$3.

This monograph on doctors who were also musicians led to its author being the recipient of the Sir William Osler Medal, a prize given to encourage interest in medical history among medical students. It is a matter for optimism that this pleasing evidence of scholarship written by so young a man as Dr. Marmelszadt appeared during the dark days of war. This optimism and the hope that interest in the history of medicine will be communicated to many of our students is the keynote of a delightful foreword by the late Victor Robinson.

Physicians have been noted for their addiction to hobbies. They are ornithologists, botanists, painters, sculptors, poets, and philosophers. It is not surprising that music should have attracted many of them. Many writers before Dr. Marmelszadt have commented on the relationship of music and medicine and drawn attention to the legend that Apollo, whose lyre furnished music for the gods, was the father of Aesculapius, the god of medicine.

The various medical men who have been musicians are mentioned. The 18th century was rich with them. The great Boerhaave, Auenbrugger, the discoverer of percussion, Goldsmith, Jenner, Withering, Arbuthnot, and Brocklesby are among them. This reviewer was pleased to see mention of Anne Hunter, the wife of John Hunter, who wrote the delightful lyric "My Mother Bids Me Bind My Hair" for Hayden. Among moderns are Billroth, Henle, Phipson, and Garrison. About Laennec, the discoverer of auscultation, he quotes Thayer's remark that anyone with an upper lip like Laennec's could not keep away from a flute. A look at a picture of the great French internist

is enough to show what Dr. Thayer meant. One surprising portrait is that of Billroth. The resemblance to Walt Whitman is astonishing, including the dress and pose.

There is an interesting little chapter on popular music, jazz, and swing. The format of the book is attractive. Altogether it is a most promising work from this young medical historian and we can hope for a notable career for him and future volumes of interest and importance.

TEXTBOOK OF MEDICINE, by various authors, edited by *Sir John Conybeare, K. B. E., M. C., D. M. Oxon., F. R. C. P., Physician to Guy's Hospital, London.* 8th edition. 1170 pages; illustrated. The Williams and Wilkins Co., Baltimore, Md., publishers, 1946. Price \$8.

This is an excellent moderate-sized practice of medicine well known not only to a generation of English medical students and physicians but to many in the United States. Its popularity is due to the concise yet fairly complete description of each disease and the practical method of presentation with brief diagnostic tables and other aids to study. There are sections on tropical medicine, common diseases of the skin, and psychological medicine. The importance of functional conditions are not as fully emphasized as might be desirable, but this is a fault common to most of our medical texts. There are a number of useful tables of normal physiological findings in the front of the book and two appendices. A table of weights and height taken from British actuarial experience gives the weights in stones and pounds, requiring a slight conversion problem for the American reader. The illustrations are not numerous but are excellent and aptly selected so that they really illustrate.

OFFICE ENDOCRINOLOGY, by *Robert B. Greenblatt, B. A., M. D., C. M., Professor of Endocrinology, University of Georgia School of Medicine; Director, Sex Endocrine Clinic, University Hospital, Augusta, Georgia,* with a foreword by *G. Lombard Kelly, M. D., Dean, University of Georgia School of Medicine.* 3d edition. 303 pages; numerous illustrations. Charles C Thomas, Springfield, Ill., publishers, 1947. Price \$4.75.

This is a small but well-printed guide to the essential and practical things in endocrinology likely to be of the most use to the medical student and general practitioner. It is not and does not pretend to be comprehensive but is as the title indicates, an office endocrinology. It contains, however, the main and best established facts, clearly presented with a minimum of words.

HUMAN BIOCHEMISTRY, by *Israel S. Kleiner, Ph.D., Professor Biochemistry and Physiology, New York Medical College, Flower and Fifth Avenue Hospitals; formerly Associate, The Rockefeller Institute for Medical Research, New York.* 573 pages; 75 illustrations and 5 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1945. Price \$6.

This is an excellent one-volume biochemistry text, very suitable for teaching purposes and sufficiently complete for much reference work. There is a brief introduction on physical chemistry and throughout there is a practical tone. The sections on foods, vitamins, and hormones are very well written and more free from fads and unsupported statements than is usual when these subjects are discussed. Only one doubtful opinion was expressed. Another subject, that on energy metabolism is also dealt with in a conservative and convincing manner.

THE DIAGNOSIS AND TREATMENT OF BRONCHIAL ASTHMA, by *Leslie N. Gay, M.D., Ph.B.*, Assistant Professor of Medicine of Johns Hopkins University School of Medicine, Director of the Allergy Clinic of Johns Hopkins Hospital. Foreword by *Warfield T. Longcope, A.B., M.D.*, Professor of Medicine of Johns Hopkins University School of Medicine, Physician in chief of Johns Hopkins Hospital. 334 pages; numerous plates and illustrations. The Williams & Wilkins Company, Baltimore, Md., publishers, 1946. Price \$5.

This is a volume by an experienced allergist who has added to his own opinions those of many other workers in this field. As the title indicates diagnosis and treatment are given first consideration but many other important subjects such as complications, asthma due to psychosomatic difficulties, etiological agents, and respiratory physiology are well covered. A valuable little work.

SURGICAL TREATMENT OF SOFT TISSUES, Supervising Editor, *Frederic W. Bancroft, A. B., M. D., F. A. C. S.*, Associate Clinical Professor of Surgery, Columbia University; Attending Surgeon, New York City and Beth David Hospitals; Consulting Surgeon, Veterans' Administration, Lincoln, and Harlem Hospitals, New York; Kings Park State Hospital, Kings Park, New York; Associate Editor *George H. Humphreys, II, A. B., M. D., Sc. D., F. A. C. S.*, Valentine Mott Professor of Surgery, Columbia University, College of Physicians and Surgeons, and Director of Surgical Service, Presbyterian Hospital, New York. 520 pages; 244 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1946. Price \$15.

This is a book of composite authorship, each section the work of specialists in particular fields. The volume is, therefore, a series of monographs welded together by the editors. There are many defects in combined and multiple authorship. They have been reduced to a minimum by the editors in this case and the result is a good manual of the surgery of the soft tissues.

The lessons of the war have been included and are to be found in every part of the work, though naturally certain sections such as those on burns, wounds, and plastic procedures have a larger share of this new material. Chemotherapy also is brought up to date. The illustrations are numerous and excellent as is the print. The use of the double column on a page detracts somewhat from the appearance and readability of the text. This, however, is the only criticism of an excellent book.

THE TREATMENT OF DIABETES MELLITUS, by *Elliott P. Joslin, A. M., M. D., Sc. D.*, Medical Director, *George F. Baker Clinic, New England Deaconess Hospital*; Clinical Professor of Medicine Emeritus, *Harvard Medical School*; Consulting Physician, *Boston City Hospital*; *Howard F. Root, M. D.*, Physician in Chief, *New England Deaconess*; Consultant in Medicine, *Eastern Maine General Hospital*; *Massachusetts State Infirmary, Tewksbury*; *Middlesex County Sanatorium*; Associate in Medicine, *Harvard Medical School*; *Priscilla White, M. D.*, Physician, *New England Deaconess Hospital*; Instructor in Pediatrics, *Tufts College Medical School*; *Alexander Marble, A. M., M. D.*, Physician, *New England Deaconess Hospital*; Instructor in Medicine, *Harvard Medical School*; Colonel, *Medical Reserve Corps, U. S. Army*; Chief, *Section of General Medicine, Branch No. 1 (New England), Veterans' Administration*; and *C. Cabell Bailey, M. D.*, Physician, *New England Deaconess Hospital*; *Research Fellow in Medicine, Harvard Medical School*. 8th edition, revised. 861 pages; numerous illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1946. Price \$10.

Dr. Joslin is probably known to more physicians in this country as an authority on diabetes than any other man. He has made it almost a lifetime study and the book is the experience of himself and his co-authors with almost 30,000 uses. Of great interest is the study of about 250 children under treatment for more than 20 years. The discovery of insulin by lengthening the life of the diabetic has also made him susceptible to the cardiac, renal, eye, and numerous other complications over a greater period of time. These special fields receive much attention.

Dr. Priscilla White's work on children is of particular importance. Every practitioner has some diabetic children among his patients and this section of the book will be examined with profit.

Not the least interesting are the valuable and authentic discussions in the number of diabetics in the United States and other countries, increase of incidence, heredity, marriage of diabetics, insurability, and similar medical and social factors. This is a sound book full of important information on a most important medical subject.

PENICILLIN IN NEUROLOGY, by *A. Earl Walker, M. D.*, Associate Professor of Neurological Surgery, *University of Chicago*, and *Herbert C. Johnson, M. D.*, Resident Neurological Surgeon, *University of Chicago*. 202 pages; numerous illustrations. Charles C Thomas, Springfield, Ill., publisher, 1946. Price \$5.

This monograph represents a thorough survey of the literature on the use of penicillin in neurology plus the results of experimental work carried out by the authors. The material is well presented and there is an extensive bibliography. The dosages of penicillin and methods of administration for best results in infections of the nervous system are discussed and sharpened by reports of experimental results in animals and man. The not so commonly appreciated toxic effects of penicillin

on the nervous system are brought out. This book should appeal to any physician who has occasion to treat infections of the nervous system.

MANUAL FOR DENTAL TECHNICIANS, with a supplement on Acrylics, by *J. A. Salzmänn, D. D. S., Chairman, Committee on Courses for Dental Technicians and Head of Dental Service, New York City Vocational Schools; Editor, New York Journal of Dentistry; Author of Principles and Practices of Public Health Dentistry.* 346 pages; numerous illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1946. Price \$5.

This is a reprint of the 1938 edition and does not contain any new material. It is essentially a manual of full denture laboratory technics and touches only briefly on partial dentures. The text contains no mention of or any information on any type of partial denture frameworks or crown and bridge procedures.

The manual is arranged in project form and is quite thorough and complete on the subjects covered. However, new types of equipment and materials have made the sections on deflasking and vulcanite obsolete.

The other portions which are still applicable are well illustrated with drawings and photographs. These add greatly in making an instructive and easily understood text. The manual also contains helpful outline forms of the various projects and a glossary which should prove useful to a person who is unfamiliar with dental prosthetic terminology.

INTRACRANIAL COMPLICATIONS OF EAR, NOSE AND THROAT INFECTIONS, by *Hans Brunner, M. D., Associate Professor of Otolaryngology, University of Illinois College of Medicine, Chicago.* 444 pages; numerous illustrations. The Year Book Publishers, Inc., Chicago, Ill., 1946. \$6.75.

This book comes as a timely reminder that intracranial complications continue to be encountered in oto-rhino-laryngological cases.

The first section of 84 pages covers the anatomy and physiology involved in a very concise but complete and well-illustrated manner. Emphasis is placed on practical application.

The second section covers the symptoms and diagnosis of the various intracranial complications of ear, nose, and throat infections and brings up-to-date, the treatment of these conditions, especially in regard to chemotherapy. In chapter 3 "Inflammatory Diseases of the Dural Sinuses; Septicemia," the treatment with sulfonamides, penicillin, and tyrothricin is discussed fully, giving their uses and limitations and the variations in symptoms and treatment caused by their previous use in the primary condition.

An excellent reference book for the otolaryngologist.

DISEASES OF METABOLISM, Detailed method of Diagnosis and Treatment; A text for the practitioner, edited by *Garfield G. Duncan, M. D., Director of Medical Division, Pennsylvania Hospital; Clinical Professor of Medicine, Jefferson Medical College, Philadelphia, Pa.*; with contributions by *Walter Bauer, Hugh R. Butt, Abraham Cantarow, Tracy Donald Cuttle, Garfield George Duncan, Frank Alexander Evans, Ferdinand Fetter, Joseph Marchant Hyman, Jr., Martha A. Hunscher, Friederich Klemperer, Cyril Norman Hugh Long, Perry MacNeal, Edward H. Mason, Max Miller, Louis H. Newburgh, John Punnell Peters, W. D. Robinson, Tom D. Spies, Leandro Maues Tocantins, Abraham White, and Alexander W. Winkler.* 2d edition. 1,045 pages; numerous illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1947. Price \$12.

This book is described in the subtitle as a text for the practitioner giving detailed methods of diagnosis and treatment. This is the expressed objective and it has been attained by the various writers. The first half is taken up with monographs on carbohydrate, protein, lipid, and mineral metabolism. This is followed by sections on water balance and the nutritional and metabolic aspects of blood diseases and the vitamins. The clinical conditions, gout diabetes, obesity, and the diseases of the thyroid and kidney form the remainder of the book.

These clinical parts of the book contain not only excellent descriptions and helpful diagnostic procedures but the questions of etiology and treatment are modern and contain a properly sceptical attitude toward many of the standard practices, which in such diseases as gout have become traditional yet need to be examined in the light of modern knowledge.

There is a good appendix containing valuable tables. It is unfortunate that tables of height and weight have not been given based on body type. One of our greatest needs is for a table based on body type as well as age and sex and some other factors bearing on height and weight.

PRINCIPLES AND PRACTICE OF OBSTETRICS, by *Joseph B. DeLee, M. D., Late Professor of Obstetrics and Gynecology, University of Chicago; Consultant in Obstetrics, Chicago Lying-in Hospital and Dispensary; and J. P. Greenhill, M. D., Attending Obstetrician and Gynecologist, Michael Reese Hospital; Obstetrician and Gynecologist, Associate Staff, Chicago Lying-in Hospital; Chairman Department of Gynecology, Cook County Hospital; Professor of Gynecology, Cook County Graduate School of Medicine.* 9th edition. 1,011 pages; 1,108 illustrations on 860 figures, 211 in color. W. B. Saunders Co., Philadelphia, Pa., publishers, 1947. Price \$10.

This new edition of DeLee's well-known and popular textbook has been almost completely rewritten by Dr. Greenhill. A number of new chapters have been added and a few found in the eighth edition have been deleted. Among interesting new material is a chapter on "Minor Disturbances of Pregnancy." This will be welcomed as it gives useful advice on conditions frequently presented to the doctor on which it is difficult to obtain information from a textbook because it has been

considered too trivial to notice or because it is lost in other material. Another timely addition is the chapter on fetal erythroblastosis and additions on anesthesia, particularly on caudal anesthesia. The relation of German measles to certain congenital defects has been included. The illustrations are beautiful examples of medical art. There are 30 pages of index which assist in ready reference. The writer of this review was brought up on DeLee, Osler, and DeCosta, and still goes to one of those three for authoritative and helpful opinions on obstetrics, medicine, or surgery. He admits that he is a prejudiced reviewer but it is believed that any medical man who uses this edition of DeLee will become as equally a prejudiced partisan of it.

MILITARY NEUROPSYCHIATRY, Collection of Papers, edited by *Franklin G. Ebaugh, Col., M. C. (Chairman), Harry C. Solomon, M. D., and Thomas E. Bamford, Jr., M. D.* 366 pages; 34 illustrations and 48 tables. The Williams and Wilkins Co., Baltimore, Md., publishers, 1946. Price \$6.

This book is a collection of the papers read before the Association for Research in Nervous and Mental Diseases at its meeting in December 1944. The articles are loosely related and touch on many phases of psychiatric problems of service personnel and veterans without throwing much light on any of them. While the book is not without merit, it is on the whole rather laborious reading. Its primary value appears to be as a record of the proceedings of the Association during its 1944 meeting.

BUCHANAN'S MANUAL OF ANATOMY, edited by *F. Wood Jones, D. Sc. (Lond., Adelaide and Melb.), M. Sc. (Manch.), M. B., B. Sc. (Lond.), F. R. S., F. R. C. S. Eng. Sir William Collins Professor of Human and Comparative Anatomy at the Royal College of Surgeons of England; sometime Professor of Anatomy in the University of Manchester. Assisted by E. L. Patterson, M. D., B. Sc. (Manch.), Lecturer in anatomy in the University of Manchester. (Nervous System, Special Senses and Glossary); T. E. Barlow, M. D. (Manch.), M. R. C. S., L. R. C. P., Assistant Lecturer in Anatomy in the University of Manchester. (Head and Neck, Thorax); S. Mottershead, M. D., B. Sc. (Manch.), F. R. C. S. Eng., Assistant Lecturer in Anatomy in the University of Manchester. (Abdomen); F. R. Wilde, M. B., Ch. B., B. Sc. (Manch.), F. R. C. S. Eng., Demonstrator of Anatomy in the University of Manchester. (The Limbs); and Jessie Dobson, M. Sc., B. A. (Manch.), Secretary to the Department of Anatomy, University of Manchester. (Biographical Notes.)* 7th edition. 1,615 pages; numerous illustrations. The Williams and Wilkins Company, Baltimore, Md., publishers, 1946. Price \$10.

Dr. A. M. Buchanan, whose portrait appears as a frontispiece, was one of the most distinguished of many eminent Scottish anatomists. This manual, at once concise yet comprehensive, is known to two generations of British physicians and has been widely used in medical schools in the United States, and the British Dominions. The reasons for its popularity are evident. The anatomic descriptions are un-

surpassed. The relations are given explicitly and clearly so that they can be used by the surgeon without question. Variations and anomalies are always mentioned. For a person doing a dissection, an operation, or a diagnostic procedure the anatomic positions and relations are clear and definite and not clouded by unnecessary and prolix description. The paper, binding, type, and illustrations are excellent and worthy of the book.

PENICILLIN—ITS PRACTICAL APPLICATION, Under the General Editorship of *Professor Sir Alexander Fleming, M. B., B. S., F. R. C. P., F. R. C. S., F. R. S., Professor of Bacteriology in the University of London, St. Mary's Hospital, London* 380 pages; numerous illustrations. The Blakiston Co., Philadelphia, Pa., publishers, 1946. Price \$7.

This book was prepared under the general direction of Dr. Fleming, the discoverer of penicillin. The various chapters are really monographs written by specialists. Among the subjects covered are the history and development of the therapy by Dr. Fleming, the prophylactic use by Porritt and Mitchell, methods of administration by Hughes and others. The pharmacy, pharmacology, and the manufacture and chemistry are described. The therapeutic applications in all fields are then given.

THE PRINCIPLES AND PRACTICE OF MEDICINE, Originally written by *William Osler, M. D., F. R. C. P.* Designed for the use of practitioners and students of medicine, by *Henry A. Christian, A. M., M. D., LL. D. (Hon.) Sc. D., Hon. F. R. C. P. (Can.), F. A. P. C. Hersey Professor of the Theory and Practice of Physics, Emeritus, Harvard University; sometime Clinical Professor of Medicine, Tufts College Medical School; Physician in Chief, Emeritus, Peter Bent Brigham Hospital; Visiting Physician, Beth Israel Hospital, Boston.* 16th edition. 1,539 pages. D. Appleton-Century Co., New York, N. Y., publishers, 1947. Price \$10.

This new edition of Osler's has a number of interesting features. First there is an introduction giving a survey of the history of medicine since the first edition of Osler in 1892. This is followed by an introduction drawing attention to the psychosomatic aspects of disease and then by a section devoted to functional diseases of the nervous system.

Although our knowledge of infectious diseases has changed more than many other branches of medicine there is less change in this subject than in most of the other descriptions in the sixteenth edition as compared with the first edition. The organic diseases of the nervous system, also a strong feature of the old Osler, has a large place in the newest edition. The tables used here are most helpful in showing localization of symptoms with neurological pathology.

The mention of tropical diseases though relatively brief is excellent. The weakest description in the book is probably that of ginger or "Jake" paralysis. The sixth edition of 1906 contained 1,143 pages.

There is thus an increase of about 400 pages. The illustrations are very few, being limited to a small number of line cuts. The paper, typography and binding are excellent.

Probably no English book in the practice of medicine had so wide a sale. Its various editions have gone all over the world. This present edition will undoubtedly be found on doctors' bookshelves everywhere and they will continue to find it an authoritative guide in many perplexities of practice.

RADIOLOGY FOR MEDICAL STUDENTS, by *Fred Jenner Hodges, M. D., Professor and Chairman, Department of Roentgenology, University of Michigan; Isadore Lampe, M. D., Associate Professor, Department of Roentgenology, University of Michigan; and John Floyd Holt, M. D., Assistant Professor, Department of Roentgenology, University of Michigan.* 424 pages; numerous illustrations. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1947. Price, \$6.75.

This book is intended for nonradiologists. It deals with the significant principles of diagnostic and therapeutic radiology. The roentgenographic manifestations of the important clinical conditions encountered by the physician are described and are correlated with good illustrations. This book is of particular value to familiarize the physician and the student with the indications and the limitations of the roentgen ray and radium in the practice of modern medicine.

TOPLEY AND WILSON'S PRINCIPLES OF BACTERIOLOGY AND IMMUNITY, revised by *G. S. Wilson, M. D., F. R. C. P., D. P. H., K. H. P., Professor of Bacteriology as applied to Hygiene, University of London, London School of Hygiene and Tropical Medicine, Director of Public Health Laboratory Service; and A. A. Miles, M. A., F. R. C. P., Professor of Bacteriology, University of London, University College Hospital Medical School.* 3d edition. Two volumes, 2,054 pages; numerous illustrations. The Williams and Wilkins Co., Baltimore, Md., publishers, 1946. Price, \$12.

The success of the two previous editions of Topley and Wilson leaves little doubt that the new third edition will be welcomed wherever a text on bacteriology and immunology is in demand. The two volumes will continue to serve admirably, both as a text for advanced students and as an excellent reference source for teachers and research workers.

There are two new chapters: One on chemotherapy, and the other on bacteriology of air. Separate chapters now appear for the Shigella, the Salmonella and on psittacosis-lymphogranuloma. The chapter on soil microbiology has been deleted. Recently, there has been an increased interest in the filtrable virus diseases. Wilson and Miles have done a commendable coverage from a systematic standpoint with special emphasis on the immunological aspects.

References are well selected, abundant, and will serve as an entry to the entire field of literature on bacteriology and immunology. Certain sections contain literature references dated as late as 1944.

There are 302 illustrations, most of which clearly portray their intended objectives.

One of the most pleasant aspects of the two volumes is their readability. Not only are the volumes comprehensive and therefore useful for reference purposes, but they are so written as to encourage a cover-to-cover reading.

PHYSICIAN'S HANDBOOK, by *John Warkentin, Ph. D., M. D., and Jack D. Lange, M. S., M. D.* 4th edition. 282 pages. University Medical Publishers, Chicago, Ill., publishers, 1946. Price, \$1.50.

This is one of those useful little books for the pocket or physician's bag. It contains numerous tables. Examples selected at random include normal findings in blood chemistry for adults and children, age differences in hematology (very convenient), differential diagnosis of jaundice, liver tests, and blood typing. Tests, diets, hormones, solutions and reagents receive attention. There is a list of common drugs arranged by therapeutic groups.

MODERN DERMATOLOGY AND SYPHILOLOGY, by *S. William Becker, M. D., Clinical Professor of Dermatology, University of Chicago, and Maximilian E. Obermayer, M. D., Clinical Professor and Chairman of the Department of Dermatology, University of Southern California.* 2d edition. 1,017 pages; 461 illustrations in text, 37 full color plates. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1947. Price \$18.

The numerous color plates make this an atlas of the subject as well as a textbook. Among other features is a chapter on tropical dermatology, a subject of particular interest since World War II. The material on syphilis is very extensive and includes not only diagnosis and treatment but enters into the sociological and public health aspects of this disease. Prenatal syphilis, neurosyphilis, and other special fields are dealt with in an adequate manner. In a single volume, the entire subject is presented so as to be of use to either the family doctor or the dermatologist.

PENICILLIN IN SYPHILIS, by *Joseph Earle Moore, M. D., Associate Professor of Medicine and Adjunct Professor of Public Health Administration, Johns Hopkins University; Physician in charge Syphilis Division of the Medical Clinic, and Visiting Physician, Johns Hopkins Hospital; Chairman, Syphilis Study Section, National Institute of Health, United States Public Health Service; Chairman, Subcommittee on Venereal Diseases, National Research Council.* 319 pages, 57 illustrations. Charles C Thomas, Springfield, Ill., publisher, 1947. Price \$5.

Everyone in medicine today knows of the high value of penicillin in the treatment of syphilis. It is generally known too that penicillin has introduced a great advance in safety in the treatment of syphilis. However, the information universally sought, but until the publication of this book not readily found, concerns the questions of how best to

use penicillin in the various types and stages of syphilitic infection and just how this new treatment has changed the outlook on prognosis and the toxic dangers of therapy.

Very concrete as well as comprehensive answers to these questions are presented in this volume. They are presented here as authoritatively, as objectively, as fully, and with all the force of masterful medical English that we have come to expect with confidence from the clinic and desk of Dr. Moore. Those who have read the previous writings of Dr. Moore and who know of the scope of the work of his staff will view the appearance of this book as an event of extreme fortune to workers in syphilology and appreciators of significant medical literature.

True to his customary approach, Moore overlooks no angles and leads one through the necessary fields of chemistry, pharmacology, toxicity, mechanism of action and then goes on through the pragmatic steps of treatment and prognosis, backed up all the way by the voluminous work and reports of a host of colleagues and others.

As in earlier forms of syphilitic therapy, the conclusions as to values are fairly definite and can for the most part be expressed by graphs and tables, but are still too involved for discussion in the space of a review—in fact the appraisal of values of treatment in all the phases of syphilitic infection can still scarcely be done in anything less than a monograph of some 300 pages, such as this new contribution of Moore's.

MENTAL MISCHIEF AND EMOTIONAL CONFLICTS, Psychiatry and Psychology in Plain English, by *William S. Sadler, M. D., F. A. P. A., Chicago, Ill. Consulting Psychiatrist, Columbus Hospital; Fellow of the American Psychiatric Association, the American Medical Association, the American Association for the Advancement of Science; Member of the American Psychopathological Association.* 396 pages. The C. V. Mosby Company, St. Louis, Mo., publishers, 1947. Price \$6.

Dr. Sadler is the author of an excellent textbook of psychiatry which many medical men remember well because it approached the subject, not from the institutional viewpoint as was usual in most such textbooks, but because it dealt with psychiatry as a problem for the general practitioner in the office and the home. This present work is, as the subtitle states, psychiatry and psychology in plain English. It is a popularization of a subject full of interest to everyone. There has been a flood of similar books since World War II, when the prevalence of neuroses in the armed forces drew national attention. Few, however, are as well written or carry such a weight of authority as does this work and it is strongly recommended as reading for both layman and physician.

DISEASES OF THE HEART, by *Sir Thomas Lewis, C. B. E., F. R. S., M. D., D. Sc., LL. D., F. R. C. P.*, *Physician in charge of Department of Clinical Research, University College Hospital, London; Honorary Consulting Physician to the Ministry of Pensions; Consulting Physician, City of London Hospital; Fellow of University College, London.* 4th edition. 304 pages; numerous illustrations. The Macmillan Company, New York, N. Y., publishers, 1946. Price \$4.50.

Most medical men, certainly all cardiologists, remember the appearance of the book by which Sir Thomas Lewis became widely known. This was *Clinical Disorders of the Heart Beat*. It represented one of the milestones in our knowledge of vascular disorders. Since that time Sir Thomas has written several other works, notably on electrocardiography and on disorders of the blood vessels. This present work is a summary for students and practitioners of the diseases of the heart distinguished by a clear and concise presentation and illumined by the insight of one of the master clinicians of an age.

The descriptions of the disease, the symptoms and signs, and the prognosis are particularly excellent. The space devoted to treatment seems to this reviewer to be a little scanty. The book forms, however, a most useful manual.

BONE AND BONES, Fundamentals of Bone Biology, by *Joseph P. Weinmann, M. D., College of Dentistry, University of Illinois, Formerly at School of Dentistry, Loyola University, Chicago;* and *Harry Sicher, M. D., School of Dentistry, Loyola University, Chicago, Ill.* 464 pages; 289 illustrations. The C. V. Mosby Company, St. Louis, Mo., publishers, 1947. Price \$10.

This interesting book will be found a valuable aid to teachers and practitioners in orthopedics, dentistry, radiology and metabolism.

The two authors, one an anatomist and the other a pathologist, have combined their knowledge to produce this volume on the normal structure and growth of bones and the pathology of bones.

Developmental disturbances and deformities of the skeleton are ably discussed. There are interesting chapters on the influence of endocrine glands and vitamins and the effect of minerals on bones. The chapters on tumors, necrosis and inflammation, and healing of bones are especially worthwhile.

The subject matter is well arranged and there are numerous excellent illustrations which follow the text throughout the book.

PERIPHERAL VASCULAR DISEASES, by *Edgar V. Allen, B. S., M. A., M. D., M. S. in Medicine, F. A. C. P., Division of Medicine, Mayo Clinic, Associate Professor of Medicine, Mayo Foundation, Graduate School, University of Minnesota, Diplomate of the American Board of Internal Medicine;* and *Nelson W. Barker, B. A., M. D., M. S. in Medicine, F. A. C. P., Division of Medicine, Mayo Clinic, Associate Professor of Medicine, Mayo Foundation, Graduate School, University of Minnesota, Diplomate of the American Board of Internal Medicine;* and *Edgar A. Hines, Jr., M. D., B. S., M. A., M. S. in Medicine, F. A. C. P., Division of Medicine, Mayo Clinic,*

Associate Professor of Medicine, Mayo Foundation, Graduate School, University of Minnesota; with Associates in the Mayo Clinic and Mayo Foundation. 871 pages, with 386 illustrations, 7 in color. W. B. Saunders Co., Philadelphia, Pa., 1946. Price \$10.

The authors, in their new book, present thoroughly and clearly a difficult subject about which there is considerable lack of clear understanding in the field of peripheral vascular diseases. The material is based chiefly on the experiences of the authors and their colleagues at the Mayo Clinic and, as the authors state, they did not hesitate to express their own opinions on controversial points, particularly with regard to therapy.

The book is divided into 31 chapters, each of which covers a distinct phase of peripheral vascular disease and its management. The chapters are well organized and include a historical introduction of the topics: anatomy, physiology, differential diagnosis, treatment, charts and tables, etc. and an excellent list of references at the end. Included in the list of chapter subjects is a definition of terms involved in discussing vascular diseases, a brief review of peripheral blood vessel anatomy, special methods of examination and diagnosis, and two chapters on the medical and surgical treatment of peripheral vascular diseases. Hypertensive disease and vascular diseases of the central nervous system were not considered to fall within the scope of this book.

The book is well written and the subject matter is complete and well presented without being too wordy and detailed. It contains 871 pages and 386 illustrations, 7 in color. The paper used is not too glossy, of good quality, and the print of a size not tiring to the eyes. It is recommended to the student interested in historical development, physiology, pathology, and methods of investigation in peripheral vascular disease; to the surgeon and internist for its completeness in diagnosis and therapy, and to others who must, by self-instruction, master this subject.

OUTLINE OF THE SPINAL NERVES, by *John Favill, A. B., M. D., F. A. C. P., Clinical Professor of Neurology, University of Illinois College of Medicine.* 191 pages. Charles C Thomas, publisher, Springfield, Ill., 1946. Price \$3.75.

CLINICAL PEDIATRICS, by *I. Newton Kugelmass, M. D., Ph. D., Sc. D.* 2d edition. 409 pages. Oxford University Press, New York, N. Y., 1947. Price \$4.

One of the justly famous Oxford Medical Outline Series. The best of their kind in the opinion of many students.

SYNOPSIS OF OBSTETRICS AND GYNECOLOGY, by *Aleck W. Bourne, M. A., M. B., B. Ch. (Camb.) F. R. C. S. (Eng.), F. R. C. O. G.* 9th Edition. 500 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., 1945. Price \$5.

Excellent compend with numerous diagrams in text.

THE DIAGNOSIS AND TREATMENT OF PULMONARY TUBERCULOSIS, by *Moses J. Stone, M. D., Assistant Professor of Medicine, Boston University School of Medicine*; and *Paul Dufault, M. D., F. A. C. P., Superintendent of the Rutland State Sanatorium, Rutland, Massachusetts*. 325 pages, illustrated with 93 engravings. Lea & Febiger, Philadelphia, Pa., 1946. Price \$3.50.

Concise practical manual with excellent illustrations.

WOMEN IN INDUSTRY—THEIR HEALTH AND EFFICIENCY, by *Anna M. Baetjer, Sc. D., Assistant Professor of Industrial Hygiene, School of Hygiene and Public Health, Johns Hopkins University*. 344 pages. W. B. Saunders Co., Philadelphia, Pa., 1946. Price \$4.

This book was issued under the auspices of the Division of Medical Science and the Division of Engineering Research of the National Research Council, and prepared in the Army Industrial Hygiene Laboratory.

AN INTRODUCTION TO HUMAN ANATOMY, by *Clyde Marshall, M. D., Formerly Assistant Professor of Anatomy, Yale University School of Medicine*. Revised by *Edgar L. Lazier, Ph. D., Associate Professor of Zoology, University of California at Los Angeles*. 3d edition. 418 pages; 303 illustrations, 13 in color. W. B. Saunders Co., Philadelphia, Pa., 1946. Price \$2.50.

Excellent elementary anatomy. Useful textbook for high schools and colleges, schools of pharmacy and nursing.

SYNOPSIS OF PHYSIOLOGY, by *Rolland J. Main, Ph. D., Professor of Physiology, Medical College of Virginia*. 341 pages; numerous illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1946. Price \$3.50.

Good companion work for an elementary anatomy in a school of pharmacy. Useful book for all medical and dental students, supplementary to a regular text.

P-Q-R-S-T, A GUIDE TO ELECTROCARDIOGRAM INTERPRETATION, by *Joseph E. F. Riseman, M. D., Associate in Medicine, Harvard Medical School; Instructor in Medicine, Tufts Medical School; Visiting Physician, Beth Israel Hospital, Boston, Massachusetts*. 2d edition. 84 pages; numerous illustrations. The Macmillan Co., New York, N. Y., publishers, 1947. Price \$3.50.

Miniature atlas of normal and abnormal electrocardiograms.

THE 1946 YEAR BOOK OF NEUROLOGY, PSYCHIATRY, AND NEUROSURGERY. Neurology edited by *Hans H. Reese, M. D., Professor of Neurology and Psychiatry, University of Wisconsin Medical School* and *Mabel G. Masten, M. D., Associate Professor of Neuropsychiatry, University of Wisconsin Medical School*. Psychiatry edited by *Nolan D. C. Lewis, M. D., Director, New York State Psychiatric Institute and Hospital; Professor of Psychiatry, Columbia University*. Neurosurgery edited by *Percival Bailey, M. D., Professor of Neurology and Neurological Surgery, University of Illinois*. 732 pages; numerous illustrations. The Year Book Publishers, Inc., Chicago, Ill., 1947. Price \$3.75.

MUSCLE TESTING; TECHNIQUES OF MANUAL EXAMINATION, by *Lucille Daniels, M. A., Director and Associate Professor of Physical Therapy, Stanford University*; *Marian Williams, M. A., Assistant Professor of Physical Ther-*

apy, Stanford University; and Catherine Worthingham, M. A., Director of Professional Education, The National Foundation for Infantile Paralysis, Inc. Designed and illustrated by Harold Black. 189 pages; 349 diagrammatic line drawings. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$2.50.

Excellent work in manual testing of muscle capacity. Of great value to physical therapist and those dealing with muscle rehabilitation after disease or injury.

BACTERIOLOGY; Laboratory Directions for Pharmacy Students, compiled by *Milan Novak, Ph. D., M. D., Professor and Head of the Department of Bacteriology and Public Health, University of Illinois, Colleges of Medicine, Dentistry and Pharmacy, Chicago, Ill., and Esther Meyer, Ph. G., Ph. D., Assistant Professor of Bacteriology and Public Health, University of Illinois Colleges of Medicine, Dentistry and Pharmacy, Chicago.* 2d edition. 248 pages; numerous illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1947. Price \$2.75.

Well-planned laboratory manual and notebook.

THE ART AND SCIENCE OF NUTRITION, by *Estelle E. Hawley, Ph. D., and Grace Carden, B. S., University of Rochester, School of Medicine and Dentistry, Strong Memorial and Rochester Municipal Hospitals, Rochester, N. Y.* 2d edition. 668 pages; 139 illustrations, including 11 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price \$3.75.

This is a well-known and standard book on nutrition with a reputation for excellence that is fully deserved. Particularly outstanding are the graphic and pictorial methods of presentation, the numerous tables packed full of useful information, and the extensive material on making up the menu for all sorts of conditions, and the emphasis on the preparation and serving of foods.

NUTRITIONAL AND VITAMIN THERAPY IN GENERAL PRACTICE, by *Edgar S. Gordon, M. D., Ph. D., Associate Professor of Medicine, University of Wisconsin.* 410 pages; numerous illustrations. The Year Book Publishers, Inc., Chicago, Ill., 1947. Price \$5.

This is one of a series of excellent general practice manuals. Sound and conservative views on vitamins are a feature and throughout emphasis on facts rather than fads is emphasized. A safe guide for the busy practitioner.

PERIPHERAL VASCULAR DISEASES (Angiology), by *Saul S. Samuels, A. M., M. D., Consulting Vascular Surgeon, Long Beach Hospital, Long Beach, New York; Attending Vascular Surgeon, Brooklyn Hospital for the Aged; Chief of the Department of Peripheral Arterial Diseases, Stuyvesant Polyclinic Hospital, New York; Fellow in Surgery, New York Academy of Medicine; Member of Committee on Surgery, New York Diabetes Association.* 2d edition. 85 pages. Oxford University Press, New York, N. Y., publishers, 1947. Price \$2.50.

Excellent little handbook, one of the Oxford Medical Outline Series.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



POLIOMYELITIS: STUDY OF AN EPIDEMIC OF FORTY CASES, KEY WEST, FLORIDA (MAY-AUGUST 1946)

Part I

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On 23 May 1946 an epidemic of poliomyelitis began on the island of Key West, Fla.—120 miles from the mainland and 170 miles southwest of Miami. During the next month and a half at least 38 cases of clinical poliomyelitis, 36 of which were paralytic, developed. One month later, 4 August 1946, 2 other cases were admitted.

The population of Key West at the time of the epidemic was about 14,000 civilians and about 3,500 naval personnel and their families.

Ten of the first 11 cases were treated at Jackson Memorial Hospital in Miami, and the remaining 28 cases (except for 2 cases which developed en route to California) were observed, diagnosed, and treated at the United States naval hospital in Key West. There had been no previous epidemics of poliomyelitis in Key West, and the average for the past 10 years was only 1 case per year.

The hospital set up a special poliomyelitis unit for the Key West area. One hundred and ninety suspected cases, in addition to the 40 positive cases, were examined and observed. Of these, 11 were believed to have abortive poliomyelitis; 22 others, probable abortive poliomyelitis; and over 100 had symptoms which remained undiagnosed. This last group complained of a combination of the following symptoms: fever, headache, muscle aches, neckache, backache, dizziness, general malaise, sore throat, transient weakness of an extremity, etc. One or more spinal fluid examinations were done on most of these cases with negative results. None of these are however included among the list of 40 patients with clinical poliomyelitis. The incidence of positive cases is 2.3 per 1,000 or 230 per 100,000.

Some of the findings in this epidemic were unusual. There was a variation in the age and sex ratio in the civilian group compared to the service personnel and their dependents.

Of the 40 cases, 19 were civilians, 16 were dependents of service personnel and 5 were service personnel.

Although 17, or 42.5 percent, of the total number of cases were among adults (19 to 33 years of age) 73.7 percent of the naval families involved were among adults, whereas only 10.5 percent of the civilian cases were adults.

Thirteen (68.4 percent) of the Navy cases occurred in officers' families although the ratio of number of officers to enlisted men was about 1 to 8. Eight of the 19 service personnel and dependents were wives of officers and 2 were wives of enlisted men. There was a strong history of contact among this group. This will be discussed later.

Of the Navy cases, two were officers (lieutenant commanders) and two were enlisted men, all of whom lived in the city of Key West. The other, a WAVE on the hospital staff, lived in the hospital barracks.

TABLE 1.—*Distribution of poliomyelitis cases by age groups*

Age (In years)	Service		Civilian		Total	Percent of cases
	M	F	M	F		
Under 1 year	1	0	0	0	1	2.5
1-2	1	1	1	2	5	12.5
2-3	0	0	0	2	2	5.0
3-4	1	0	1	0	2	5.0
4-5	1	0	2	1	4	10.0
5-10	0	1	3	1	5	12.5
10-15	0	0	3	0	3	7.5
15-20	1	1	0	2	4	10.0
20-25	0	5	0	1	6	15.0
25-30	1	3	0	0	4	10.0
30-33	2	2	0	0	4	10.0
Total	8	13	10	9	40	100.0

Of the 40 cases, 22 were females; 18 males. Of the adults, 13 were females and 4 were males.

Although the chance coincidence of poliomyelitis and pregnancy has been given as 1:1,000 poliomyelitis cases and 1:50,000 pregnancies (1), 6 of the women in this epidemic were pregnant. A seventh was 3 weeks postpartum at the time of admission.

The youngest case was 7 months old. Four patients were 30 years of age or older.

There were 3 deaths (one Navy adult, 1 Navy child, and 1 Army adult), a mortality of 8.3 percent of the paralytic cases. Five of the first 10 patients were respirator cases. There were 7 respirator cases in all.

There were three instances of two positive cases in one family. Thirteen of the 34 remaining cases gave a history of febrile illness in

1 or more members of the family at the same time which, as described, could have been mild abortive cases.

Three patients developed acute symptoms just after they left Key West (two en route to California, one to Palm Beach).

There were no cases reported among the colored population.

Only 8 of the 19 civilian cases were natives of Key West. All but 1 of these natives were children, all under 5 years of age. The only adult was the pregnant mother of 1 of the cases.

EPIDEMIOLOGY

The frost-free city of Key West, which occupies most of the terminal island of the chain of Florida Keys, is 4 miles long and 1½ miles wide. The northeastern half of the island is rimmed by Roosevelt Boulevard. In the northern part of this half of the island is located the large, wartime (civilian and Navy) Poinciana Housing Project, where 13 cases were reported.

The entrance to the island is at this northeastern end, where the naval hospital is located.

Just below the southeastern end of Roosevelt Boulevard is the small Rest Beach Housing Project (75 units) limited to naval officers' families, where 6 of the poliomyelitis cases developed.

The climate is semitropical.

The milk supply, and at least 90 percent of all other supplies for the various naval activities and the city, come from the Miami district.

It is seldom possible to narrow the mode of transmission of the virus of poliomyelitis down to a single factor. Modes of transmission which have had varying importance in the past and which were considered in this epidemic were: water, food, milk, flies, sewage pollution, and direct contact.

Water.—The water supply, delivered by pipe line from Florida City, is chlorinated at the source, rechlorinated en route, and again rechlorinated by the city and each naval station before use.

The present water line was built in 1944. Before that time the natives had to depend on rain water, which they stored in cisterns. Many of these cisterns are cross-connected to the main water lines which enter these homes. Eight hundred to one thousand cisterns are still in use and few are properly closed. It is possible that the main water supply may be contaminated by these cistern cross-connections; however, water samples have been tested weekly and have always been found to fill the requirements of standard water analysis.

Sewage disposal.—The main method of disposal is by septic tanks or cesspool since less than 30 percent of the homes are connected to the sewage disposal lines. Eight civilians and four Navy cases lived in homes where sewage was disposed of by septic tanks or cesspools.

Before the epidemic started the raw sewage was pumped through sewer lines with two outlets: one, on the northeast side of the island into the Gulf of Mexico, with an emergency bypass into Garrison Bight Basin, a shallow, semienclosed body of water; the other sewer extends 600 feet from the southeastern end of the Key into the Atlantic Ocean near South Beach, Fort Taylor officers' beach and Rest Beach which are the island's principal bathing beaches. Tidal action is very slight here and gross sewage was often observed close to shore. Subsequent to the onset of the epidemic the sewage was pumped into settling tanks and the effluent chlorinated; pumping of sewage into Garrison Bight yacht basin was discontinued.

Garbage.—Both wet garbage and trash is hauled to a "dump" near U. S. Highway No. 1 on Stock Island, the next proximal key. An attempt is made to burn and to bury the collection with one bulldozer; most efforts at burial are futile since part of the "dump" is on swampy land. Garbage is collected once a week, except in the Federal housing units where it is collected three times a week. In the housing units most garbage cans have poorly fitting lids and the cans often overflow. In the city, most of the garbage can lids were missing, others were badly bent.

Milk.—The milk, which is supplied by two dairies, is tested regularly. It is trucked in from the Miami area.

Flies.—Flies are quite prevalent throughout the city, but not in larger numbers than usual. Chickens, horses, and numerous dogs and cats are kept improperly within the heavily populated parts of the city.

A Navy plane began spraying the island with DDT as soon as the epidemic started. This spraying has been continued at frequent intervals and has greatly reduced the fly and mosquito population.

EPIDEMIOLOGICAL HISTORY

Repeated "direct contact" was the most obvious and important common denominator in at least 18 of the cases, which included 5 small groups of patients. Among other cases, flies and poorly handled garbage seemed to be particularly incriminated.

Swimming in polluted water was another distinct possibility. Eighteen of the forty cases had been bathing at Rest or South Beaches during the 2 or 3 weeks preceding the onset of their illness. (In nine cases this information was not available.— These two beaches where tidal action was slight, were located near the sewage outlet.

Table 2 gives the results of the bacteriological examination of water samples from the principal beaches and swimming pools in this area.

TABLE 2.—*Bacteriological examination of water (22 July 1946)*¹

Salt Water (100 cc. samples)	Final presumptive test				Confirmatory test			Maximum probable number
	10 ml.	1.0 ml.	0.1 ml.	.01 ml.	10 ml.	1.0 ml.	0.1 ml.	
Rest Beach pond.....	5+	3+	0	0	5+	3+	-----	79
Municipal pool.....	0	0	0	0	-----	-----	-----	-----
Weaver's Cabins.....	5+	3+	1+	0	5+	3+	1+	110
Poinciana Lake.....	5+	5+	0	0	5+	5+	-----	240
Rest Beach.....	5+	4+	4+	0	5+	4+	4+	350
Officers' club.....	5+	5+	3+	0	5+	5+	5+	920
Yacht club.....	5+	5+	4+	0	5+	5+	4+	1,600
Naval hospital.....	0	0	0	0	-----	-----	-----	-----
Naval air station bathing beach.....	0	0	0	0	-----	-----	-----	-----

¹ Courtesy of the Miami branch State Board of Health.

Since the above analysis, the sewage effluent has been chlorinated and, at the present time, samples show no evidence of pollution. Swimming was prohibited at all service pools and at the officers' club beach as soon as the epidemic began.

The occurrence of over one colony of gas-forming *B. coli* (coliform-aerogenes) group per 100 cc. sample from deep salt water and more than five colonies per 100 cc. from surface water is evidence of pollution.

It is to be noted that all the sites except municipal pool, naval air station bathing beach, and the naval hospital contained gross pollution. The greatest pollution (expressed as MPN—maximum probable number) occurred in Garrison Bight, and the officers' club, both in closest proximity to the sewage outlets.

The last important factor seemed to be visits to Miami where there were a number of cases of poliomyelitis. Thirteen of the patients had either been in Miami, where there were a number of cases of poliomyelitis, within the preceding 3 weeks or had Miami visitors in their homes. At least five of the cases were apparently contracted in Miami. Miami, Fla. and Havana, Cuba were the two cities of size nearest to Key West. The Key West epidemic began 23 May when the peak of the Miami epidemic was reached. There was also an epidemic at this time in Cuba (90 miles away, by air).

In the next 6 weeks, 37 positive cases developed. The cases were fairly evenly distributed throughout this period. The longest interval between cases was 5 days. The greatest number of cases in 1 day was 5.

A month after the epidemic was apparently over, an adult male and a pregnant woman were admitted.

The development of the epidemic may be briefly sketched as follows:

The first case, a 2-year-old girl, was the daughter of an iceman who had been making regular trips to Miami to visit his wife (who had a febrile illness not diagnosed as poliomyelitis). This patient lived in downtown Key West.

Eight of the next nine cases (Nos. 2, 3, 4, 6, 7, 8, 9, 10) were from the Poinciana area. Five of these eight (all children) had played together frequently and had come down with clinical signs of poliomyelitis about the same time. Three of them had played near a large pool of stagnant water in the back yard, which was subsequently condemned by the city. Three had been in swimming at Rest Beach or South Beach. Three had made recent visits to Miami or had Miami visitors.

The case mentioned above (No. 5) who did not live in Poinciana was the wife of an officer aboard one of the submarines, and lived at Rest Beach. Ten days later the executive officer aboard the same submarine and friend of case No. 5 developed acute bulbar poliomyelitis (No. 17). Significantly, 2 months later the wife of an enlisted man on the same submarine was admitted with poliomyelitis (No. 39). The families of No. 5 and No. 17 were in frequent contact. The children of case No. 19 played frequently at the home of case No. 5. Two weeks after case No. 5 was admitted cases Nos. 19, 20, and 21 were admitted with acute preparalytic poliomyelitis. These three were pregnant women, good friends, two of whom were next door neighbors at Rest Beach; the third lived in Poinciana. They had been at parties together and were frequent visitors at each other's homes. Ten days after case No. 19 developed acute symptoms of poliomyelitis, her husband developed acute symptoms of poliomyelitis and died 5 days later of bulbar poliomyelitis (No. 28).

Case No. 11 was the wife of an enlisted naval man. She had been in Miami 2 days before the onset of her illness. She had no history of contact nor did cases Nos. 12 and 14 (both children). Case No. 12, a 10-year-old boy, had arrived in Key West from New York 3 weeks previously. There were many flies about their premises, a horse next door and goats across the street. The patient had been in swimming at South Beach.

Case No. 13, another child, gave no history of contact, but 11 days later a waitress who had lived in the same apartment house with her developed poliomyelitis (No. 15). The waitress had had a recent visit in Miami and had swum at South Beach. A son of a steady customer was said to have poliomyelitis. Fifteen days after No. 13 developed poliomyelitis, a child across the street, No. 27, also developed poliomyelitis. The latter child's father ran a lunch room.

Whereas 12 of the first 14 cases were in children, 6 of the next 7 cases were adults. Case No. 15, wife of a commander aboard another submarine, began having prodromata while on a visit to Miami, and developed acute symptoms 8 days after returning to Key West. On the same day she was admitted to the hospital, the 17-month-old son of the executive officer aboard the same submarine was admitted with poliomyelitis (No. 16). As a matter of fact, the boy (No. 16) fre-

quently visited her house (No. 15). Significantly, no other cases were reported from the families aboard this submarine.

Cases Nos. 22, 24, and 27 had no known contacts. They had swum at Rest Beach. In each of these cases there were chickens on the premises or next door, and many flies.

Case No. 23, a 2-year-old girl, was very interesting since her parents claimed to have strictly isolated her on the day the first case of poliomyelitis was reported in Key West. She drank boiled milk and water, was allowed no visitors, was not allowed outside. The family raises chickens. Garbage cans were sprayed with DDT. Two doors away, however, there was a filthy yard with many flies.

Case No. 25 gave no history of contact. His parents had been in Miami 3 weeks previously, and he had been to nursery school in the Poinciana area.

Case No. 26, an Army private who lived in Poinciana, gave a negative history. He had been on a fishing party where everyone drank from the same bottle of water. One of his companions on the party subsequently came down with what was thought to be abortive poliomyelitis.

Cases Nos. 29, 31, and 32 all developed about the same time. Nos. 29 and 32 were a native boy, age 3, and his mother (in her third trimester of pregnancy). Case No. 31 was a nearby neighbor's son who visited frequently at her home and who, 3 weeks previously, had just moved to Key West from Miami.

Case No. 30 was a 19-month-old baby from Rest Beach who, 3 weeks before, had moved over from Poinciana.

Case No. 33, an officer's wife, was admitted 3 weeks postpartum. She had been visited in the hospital by the mother of a poliomyelitis patient about 17 days prior to admission. It was subsequently known that her husband had a febrile illness, with headache, stiff neck and back, for 3 days but did not consult a doctor.

Case No. 34, a WAVE who lived in the hospital barracks, returned from 14 days' leave 4 days before she became ill. She had been in Miami 2 days. She had swum at Rest and South Beaches. She had dated the Army doctor who, 11 days previously, had examined and brought in case No. 26. Her roommate developed probable abortive poliomyelitis 3 days after she was admitted. Significantly, this was the only case of typical abortive poliomyelitis seen among the hospital staff.

Case No. 35, an officer's wife recently treated for menorrhagia and "influenza," developed acute symptoms on the way to Palm Beach. Her husband daily brought home the husbands of cases Nos. 20 and 21 from work.

Case No. 36, the pregnant wife of a medical officer at the submarine base dispensary, had been in the hospital 2 weeks previously with an

attack of pyelitis. No contact history. She had been swimming at Rest Beach regularly.

Cases Nos. 37 and 38, sons of a commanding officer of another submarine, were strictly isolated at home ever since the epidemic began. They remained at home and were allowed no visitors. However, their parents had been in Miami 2 weeks before their children developed acute symptoms. These children were leaving this area to escape contagion, but developed the disease en route to California.

Case No. 39, the pregnant wife of an enlisted man aboard the same submarine as the husbands of cases Nos. 5 and 17, gave no history of contact. She became acutely ill 1 month after the last reported case. She had not been swimming. She had stayed at home and avoided crowds. She did, however, attend a dance 3 weeks prior to her admission. Garbage and sewage disposal were satisfactory.

Case No. 40 was a chief at the submarine base. His wife had a febrile episode with stiff neck about 10 days before. He had been swimming regularly at South Beach twice a week.

From the standpoint of possible incrimination of flies and garbage it is interesting to study the east to west spread of poliomyelitis in Poinciana, the earliest and largest single area hit (13 cases). There are 4 groups of dwellings in this area.

To the east is Poinciana Place (a housing project of 210 dwelling units) in the region of which 8 cases developed. Near this project, to the east, there is a stable of horses, goats, and poultry where flies breed in large numbers. The prevailing breeze is from the east or southeast. The first group of cases (Nos. 2, 3, 4, 6, 8, and 10) came from this area.

Adjoining, westward, is Poinciana Extension (of 550 dwelling units) where only 1 case (No. 26) developed, 3 weeks later.

Further west is West Poinciana (140 housing units) where the next 2 cases (Nos. 7 and 9) developed, and the MacArthur Homes (Nos. 16 and 17 being reported in this and the adjoining area).

It is noted that the largest housing project, 550 units, had the least number of cases—1. On inspection, this project had much fewer flies than did the other areas. For example, no fly larvae were found in the Poinciana Extension, while about 25 percent of the garbage cans in West Poinciana contained fly larvae.

Practically all these units have the same water supply, the same sewage system, receive milk from the same dairy, and the tenants have the same social and financial status, which seems to suggest that these factors were not incriminated in this epidemic.

It is also noted that in the 2 other housing projects, Porter Place (136 units) and Fort Village (158 units), there were no cases reported. Their location was far removed from the Poinciana and Rest Beach areas.

Also, at the homes of 15 of the 24 patients not in the Poinciana area, the garbage and fly situation was described as "bad" either on the premises or next door. Garbage cans often contained many maggots.

Thus, direct contact, flies, and the beaches (polluted water) could not be excluded as important factors in the local spread of the disease.

PREDISPOSING FACTORS

The influence of several varied conditions on the susceptibility of poliomyelitis has been much discussed. It has been claimed, for example, that a recent tonsillectomy wound may provide an easy path of entry for the virus, particularly predisposing to bulbar involvement. None of the 40 patients in this series had had a tonsillectomy in the past 2 years.

Increased fatigue or excessive exercise is said to be a predisposing factor. Four patients gave a history of recent excessive work or exercise.

It has been noted that people who develop poliomyelitis are usually well-nourished, and healthier than the average. All but four of the patients could be considered as well-nourished, above the average. Three had recent illnesses (No. 36—pyelitis with pregnancy, 2 weeks previously. No. 35—fever following immunizations, 4 days previously). One patient was malnourished and had been drinking heavily prior to admission. One patient was a recent parturient.

The influence of pregnancy on susceptibility to poliomyelitis is not known. The incidence in this epidemic (6 pregnant, 1 parturient: 17.5 percent of the cases) is the highest ever reported in an epidemic of poliomyelitis. In 1945 Fox and Sennett (10) stated that there were only 85 cases reported in the literature.

Aycock (9) believed that endocrines can influence resistance or susceptibility to poliomyelitis. He injected poliomyelitis virus intravenously into castrated female monkeys and normal controls. Some of the castrated monkeys were prepared by receiving a course of estrogen therapy. He reported that the estrogen prepared animals showed a significantly increased resistance to poliomyelitis, and in those who did succumb, the onset of the disease was delayed. He also showed that a group of poliomyelitis cases had a higher urinary excretion of estrogens than did the normal controls.

Why, then, does not the higher amounts of estrogen in pregnancy protect the patient? The answer seems that the hormonal status of the pregnant women differs from that of the nonpregnant as well as the castrate animal. While estrogens increase in pregnancy, pregnancy is dominated more by progesterone (produced by the corpus luteum and also by the placenta). Estrin and progestin are physiologically antagonistic to each other. Since other normal secretions,

as pituitary, are also increased during pregnancy, the end effect of several intricating variables, including increased estrogen, may differ from the effect of increased estrogen alone.

The estrogen effect may be pronounced or more unopposed during the first trimester. This might explain Weaver and Steiner's (11) report that 3 of 13 rates inoculated during the first trimester of pregnancy resisted infection with poliomyelitis virus, whereas all animals inoculated in the second and third trimester, as well as virgin animals, were uniformly susceptible. It might explain the incidence of poliomyelitis in 75 human cases (cited by Weaver and Steiner (11) when divided into trimesters: First trimester, 17.1 percent; second trimester, 34.3 percent; and third trimester, 48.6 percent. In our series, 1 patient was in the first trimester, 4 in the second, and 2 in the third. Was the onset of the disease delayed in the pregnant woman? It was not possible to say. However, 4 were among the last 8 patients admitted. The other 3 were admitted in mid-epidemic. The only case in the first trimester was No. 39 (ninth week of pregnancy).

One thing which all these pregnant women (six Navy wives, one civilian) had in common was their abundant use of vitamin supplements. Five other patients took additional vitamins regularly; five did not; in the remainder, this information was not available. This is of some interest since Foster and associates (1922-44) (1) in experiments with mice on different levels of thiamine intake, reported the incidence of paralysis in mice injected with murine poliomyelitis virus (Lansing strain) on the high B₁ diet to be several times that in mice as the B₁-deficient diet. Similar observations were made by Ramussen et al. (6). In some instances when thiamine-deficient mice were subsequently given adequate thiamine they became paralyzed after a prolonged incubation period. Partial starvation of the animals on a complete diet also increased the resistance of mice to the virus, but it was demonstrated that vitamin deficiency exhibited a greater protection than did the restriction of food intake, indicating the effect of the vitamin deficiency could not be entirely due to inanition. Induced deficiencies of vitamin B₂ complex, vitamin B₆, protein and tryptophane had no effect on the resistance.

Draper (12) described a certain constitutional type of child as susceptible to poliomyelitis.

Briefly, these children who develop poliomyelitis are large for their age; they are all broad-faced, high cheek-boned children. Their eyes are very wide-set. The space between the inner canthi is also wider than normal, so the whole expression is that of a very flat-faced, broad, almost Icelandic type.

In addition to this: there is a definite design of the bony skeleton, especially of the skull and hands. The gonial angle between the posterior border of the ascending ramus and inferior border of the horizontal ramus is wide, and the subcostal angle is narrow. The teeth are large for the size of the face and usually irregular. * * *

This disease occurs almost entirely in the brunette * * * if you will observe (the) blondes very closely, you will find that they are covered, in many cases literally covered, with deeply pigmented spots. * * *

Mothers of many poliomyelitis patients are thyroid types * * * many of the fathers are of the eunuchoid giant form of the Froelich type. The genital inadequacy of the boys with poliomyelitis is very striking. * * *

Cases Nos. 16 and 27 fit his description well. However, the description was of little clinical aid. Incidentally, five of the patients had blonde or almost blonde hair and fair complexion; four others were of fair complexion and had light brown or brown hair.

It has been suggested that some families are constitutionally more predisposed than others to diseases of the nervous system. Surprisingly, three of the patients reported the previous incidence of poliomyelitis in their families. The aunt of case No. 14 was a poliomyelitis victim in Key West 7 years ago. The nephew of case No. 20 and the sister of case No. 24 also were said to have had poliomyelitis.

INCUBATION PERIOD

About half of the 40 patients gave a history containing clues as to the length of the incubation period. For example, patient No. 28 who died of bulbar poliomyelitis, developed acute symptoms 17 days after his wife's (No. 19) prodromata and 10 days after she became acutely ill. Case No. 19 was admitted with acute symptoms 15 days later than case No. 5, at whose home her children played. Case No. 12 had moved to Key West from New York less than 3 weeks before he became ill. Case No. 15 had just returned from a week-end visit to Miami 10 days before she became ill. Case No. 33 was visited, in the hospital after the birth of her baby, by the mother of a poliomyelitis patient almost 3 weeks before she was taken sick.

On the basis of such reasoning the incubation period ranged between 7 to 22 days among this group of cases and averaged about 2 weeks. This is about the average usually ascribed to paralytic cases. The range of incubation period is usually given as from 5 to 35 days.

CLINICAL OBSERVATIONS

Symptoms.—In four-fifths of the cases there was a definite prodromal period of from 1 to 8 days (in one case, 3 weeks). Most often the prodromal period was 1 to 4 days and consisted of some of these symptoms: general malaise, weakness, fever, irritability, fatigue, sore throat, muscle pains, insomnia, headache, dizziness, and nausea.

The presenting acute complaint depended on the stage when the patient was first seen. Three-fourths of civilian cases (mostly children) were first seen in the paralytic stage, hence a limp or the inability to walk was the most common complaint in these cases, along with fever and headache. Over half of the Navy patients (largely

adults) were seen in the acute preparalytic stage. An additional one-quarter was first seen with minimal prodromal complaints, so that the natural course of events in this disease was clearly demonstrated.

The onset of acute symptoms was gradual in 35 of the cases. In the other 5 cases the symptoms were first noted on awakening in the morning. The earliest acute symptoms were usually mild fever, headache, sore throat, backache, neckache, malaise, and vomiting. Headache (in 4 instances, severe) was the most common complaint, being recorded in 27 cases. Only 4 patients reported no headache. (The 9 other patients were small children.) All but 1 of the adults complained of headache. Duration of headaches before admission varied from 1 to 8 days, usually 1 to 3 days.

Malaise, drowsiness, irritability, and restlessness were frequent complaints. Only three patients claimed not to have this group of symptoms. Nine patients complained of all four.

The highest preadmission temperature was said to be 105° F. The admission temperature depended partly on the stage at which the person was seen, since the temperature is usually highest in the acute preparalytic stage. The highest temperature on admission was 104° F. The average was a little above 101° F. Seven patients had a normal temperature (under 98.6° F. orally, under 99.6° F. rectally) on admission; two were in the preparalytic stage. (After admission the temperature of one rose from 98.4° to 101° F.; the other, from 98° to 100° F.) This is an important point in an epidemic. Since fever is usually one of the cardinal findings in an infection, a suspected case of poliomyelitis with no fever but with mild symptoms may be prematurely dismissed. In a suspected case, it is worthwhile to routinely inquire about recent fever, though the temperature at the time of examination is normal.

CASE No. 40.

This 33-year-old enlisted man was seen on 6 August 1946 complaining of moderate headache and slight stiffness of the neck. Eight days before admission he first began to feel malaised. During the next 5 days he complained of indigestion, fatigue, absent mindedness, and continued malaise. Three days before admission he developed a severe headache, which went away after an hour and which returned the same night, along with fever (which his wife first noted). Two mornings before admission he became nauseated, and his back and neck felt stiff and hurt slightly on flexion. Examination by the dispensary doctor was said to be entirely negative at the time. His headache and back and neck ache were gradually disappearing, and except for the mild headache, the patient felt well on admission. His wife had made him come in for a check-up. He had had no fever in 2 days. Ten days before, his wife had complained of fever and neck stiffness.

Examination.—Temperature 98.4° F., pulse 72, respiration 22. The examination was entirely negative except for some pain in mid-back when the patient bent his head between his knees. There was no limitation of motion. Reflexes were normal.

Laboratory.—Spinal fluid: 521 white blood cells (18 polymorphonuclear leukocytes, 503 lymphocytes). White blood count: 6,000 with 46 percent polymorphonuclear leukocytes and 54 percent lymphocytes. Sedimentation rate 6 mm./hr. (Westergren).

Hospital Course.—The day after admission the patient's headache almost completely disappeared. He has been asymptomatic except for mild malaise. He is quite limber and has developed no subsequent weakness or paralysis (the second nonparalytic case in this series).

Furthermore, the patient may give no history of fever, despite its presence. Case No. 21, a 23-year-old woman, had a temperature of 101.8° F. on admission and a 14-year-old patient (No. 10), 102° F. on admission, yet neither had experienced the sensation of fever.

In this series fever was present from 1 to 21 days before admission, usually between 1 to 3 days. There were nine instances of recurrent fever (two episodes). Fever lasted from zero to 9 days after admission, averaging about 4 days. Five children ran a low-grade "fever" throughout their 3 weeks or more of hospital stay (up to 100° F. to 100.6° F. daily—rectally).

The highest temperature was 107.6° F. (rectally), recorded on case No. 26 who died of an ascending Landry's type of spino-bulbar poliomyelitis, 7 days after admission.

Only 4 patients noted chills. Sore throat, occasionally marked, occurred in at least 18 patients. Fifteen patients (including 4 of the 6 pregnant women) complained of nausea and vomiting; 8 others experienced only nausea. Definite diarrhea occurred only twice among the 40 cases, but 3 others reported loose or slightly increased bowel movements. Seven patients complained of constipation. All except 2 of the patients gave a history of very slight to moderate neckache and backache and stiffness prior to admission. Five children complained of abdominal pain. Dysphagia was initially present in 4 patients, regurgitation of fluids in 2, dysuria or oliguria in 4 (not including the pregnant women), aphonia or dysphonia in 2, and tremors in 3. Fourteen patients complained of stiffness or pain in muscles other than the neck and back.



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A SCHICK SURVEY ON GUAM

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This study was done in 1946 as part of an over-all Child Health Service Program. The Schick toxin used was of a standard make and obtained from the U. S. Naval Medical Supply Depot and it was of normal potency.

Over 400 nose and throat swabs were taken, but no diphtheria bacilli were isolated from the cultures.

No blood antitoxin determinations were done, due to a lack of proper laboratory facilities.

Over 4,000 children were included in the study, approximately 100 for each age by year and for each sex.

Schick readings were made 5 days after administration of test.

COMMENT

Table 1 shows our results of positive reactors by *age* and *sex*, and table 2, compiled by Schick (1), shows incidence of positive reactors in the same age groups in white children.

A striking difference in incidence rate is very apparent. This totally unexpected low incidence of positive reactors in the native population group was very puzzling indeed, for just the reverse was expected, for the Guamanian children were never artificially immunized against diphtheria, nor were they known to be exposed to the disease.

A search of the literature however disclosed, that similar observations were also made by others in previous studies.

Kleine and Kroo (2) tested over 100 East African natives, 95 percent of whom were children between 6 and 15 years of age. No positive reaction was obtained in the entire group. Serum was obtained from 11 of the natives tested. Ten showed high antitoxin levels, in spite of the fact, that the general population has not been exposed previously to diphtheria.

Asbelew and Margo (3) tested over 100 inhabitants of an Arctic island of a total population of 250. All except one girl of 8 years were found to be Schick negative, though diphtheria was never reported on that island.

Talliaferro (4) tested a large number of individuals on Honduras and found that only 9.6 percent of the native school children had a positive Schick reaction as compared with 55.8 percent in white children on the same island.

Wells (5) on the other hand found a high incidence rate of positive Schick reactors among Central and Polar Eskimos and also a low antitoxin titer in their sera.

Dr. Bella Schick (6), in a personal communication, mentions that Gomez and Navarro in the Philippines found 70 percent Schick-positive reactors in children 2 years of age, while the adult population gave only a 6.3 percent Schick-positive incidence rate. He also states, that Jones in Greenland found all children below 12 years of age to be Schick-positive, while all the older members of the same families were Schick-negative, though diphtheria has not been reported in Greenland. Dr. Schick suggests the possible presence of bacilli carriers on Guam to explain the low rate of positive reactors and states, that tropical climates apparently protect against active clinical diphtheria because the mucous membranes are not damaged by frequent sore throats and thus able to resist invading bacilli.

Ramon (7), after a review of the literature on the mechanisms involved in the acquisition of natural immunity, concludes that latent infection with the organism is generally responsible for a natural immunity. It is well known that Schick reaction rates differ widely with different populations, but it has been found to be generally true that Schick reaction will be positive in larger percentage of people in rural communities as compared with urban populations. The incidence rate is also found to be higher among children of the upper classes who are apparently less exposed to contact with diphtheria than those of the poorer classes. Where diphtheria has long been absent the Schick positive reaction may rise to almost 100 percent. Latent infection therefore does play a dominant role in the production of natural immunity. It is not however the sole answer, and the subject of natural immunity is still a debatable question.

Several theories have been offered :

Hirszfeld's physiological maturation theory believe that it is due to the low carrier rate of virulent organisms in a population in direct relation to a high immunity rate. This theory would tend to explain the presence of a high immunity rate in native populations where clinical diphtheria is rare. It would also explain the presence of natural immunity in some animals such as the horse or monkey, though clinical diphtheria has never been demonstrated in these animals.

Another theory claims that natural immunity is due to latent infection. This is called the Herd Immunization Theory. Specific antigenic stimulation is provided according to this theory by contact with diphtheria bacilli of varying grade of virulence and not necessarily with clinically recognizable diphtheria.

It is conceded that generally antitoxin production is determined by the degree of exposure to infection and also as a response to artificial active immunization, yet our study and those of other observers would indicate that at times spontaneous antitoxin production may be encountered in certain populations, though not known to be exposed to the disease nor to have been actively immunized.

One wonders whether the prevalence of tropical ulcers and yaws in native population on Guam wherein many diphtheroid and diphtheria organisms are found may not be responsible for the antitoxin production. It is also possible that heredity may play a part in acquisition of natural immunity.

It is obvious from the foregoing that further well-integrated studies bacteriological and immunological on large groups of native populations are still needed in order to definitely determine the various factors involved in the causation of a natural immunity.

SUMMARY AND CONCLUSIONS

1. Results of a Schick study on Guam are presented.
2. Only 5.9 percent were found to be positive reactors in a non-immunized and presumably nonexposed native population.
3. Incidence rate slightly higher among the females.
4. Greater number of positive reactors found between ages of 1 and 4 years.
5. Cause of low incidence rate not definitely known. Several theories are mentioned.
6. Further well-integrated studies to throw more light on the subject are still needed.

TABLE 1.—Percentage of positive Schick reactors among Guamanian children who were previously not immunized nor exposed to diphtheria

Age	Male			Female		
	Number tested	Number positive	Percent positive	Number tested	Number positive	Percent positive
0-6 months	102	3	2.8	104	3	2.8
6-12 months	105	9	8.5	102	8	7.8
1-2 years	110	16	14.5	106	17	16.0
2-3 years	106	19	18.0	101	18	17.8
3-4 years	98	12	12.2	103	14	13.6
4-5 years	103	10	9.7	108	12	11.1
5-6 years	107	9	8.4	104	11	10.5
6-7 years	102	7	6.7	103	10	9.7
7-8 years	100	5	5.0	101	8	7.9
8-9 years	97	4	4.1	105	6	5.7
9-10 years	104	4	3.8	100	5	5.0
10-11 years	104	4	3.8	103	4	3.8
11-12 years	101	3	2.9	101	3	3.8
12-13 years	105	2	1.9	103	2	2.9
13-14 years	103	2	1.9	101	2	1.9
14-15 years	100	1	1.0	104	2	1.9
15-16 years	104	2	1.9	103	2	1.9
16-17 years	102	1	.9	105	1	.9
Over 17 years	208	2	.9	203	2	.9
Total	2,061	115	5.5	2,060	130	6.3

Total number tested, 4,121; total percentage positive, 5.9; total number males tested, 2,061; total percentage positive males, 5.5; total number females tested, 2,060; total percentage females positive, 6.3.

TABLE 2.—*The reaction to the Schick test at various ages*

Age	Percent positive Schick test	Percent negative Schick test	Age	Percent positive Schick test	Percent negative Schick test
Newborn	16	84	7-8 years	44	56
0-3 months	28	72	8-9 years	37	63
3-5 months	43	57	9-10 years	32	68
6-7 months	57	43	10-11 years	29	71
7-8 months	63	37	11-12 years	28	72
8-9 months	84	16	12-13 years	24	76
9-10 months	93	7	13-14 years	23	77
10-11 months	87	13	14-15 years	20	80
11-12 months	91	9	15-16 years	18	82
1-3 years	83	17	16-17 years	18	82
4-6 years	61	39	Over 17 years	14	86
6-7 years	50	50			

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THE INCIDENCE OF INTESTINAL PARASITES AMONG CIVILIANS EMPLOYED AT CERTAIN NAVAL AIR BASES

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The authors arrived at Parnamarim Field, Natal, Brazil, early in 1943, to provide the malarial control organization for a fleet air wing which was newly formed and in the process of taking control of the existing facilities.

Aside from mosquitoes, an immediate insect problem to be solved was the tremendous housefly population that was literally swarming

in tents, barracks, galleys, and mess halls. In making the initial survey to discover the source of the fly breeding, it was noted that the engineering organization in charge of constructing the base was not supplying heads of any description for the hundreds of native laborers employed. This naturally resulted in very heavy fecal pollution of the soil in the scrub brush which was immediately adjacent to the building area.

Since many of the stools showed evidence of diarrhea, it was decided that, as a matter of interest, a few microscopical examinations should be made. Fifteen fresh-appearing samples were taken to the laboratory in sputum cups. No method of concentration was employed. The smears were prepared with normal saline solution. In later work, iron-haematoxylin stain was utilized to provide permanent smears. The results obtained in this small series were somewhat startling (see table 1). Each stool sample contained at least one species of parasite, and a total of six was discovered in one smear. Nine species of parasites were observed. Naturally, with nearly half of the stools showing the presence of *E. histolytica*, it was imperative that all native waiters and dishwashers be examined and those infested with organisms capable of food contamination be eliminated.

TABLE 1.—*Species and incidence of intestinal parasites obtained from a preliminary survey, 15 stool samples, Natal*

Species	Number	Percent
<i>Ascaris lumbricoides</i> Linn.....	10	66.6
<i>Endamoeba coli</i> Grassi.....	10	66.6
<i>Necator americanus</i> Stiles.....	9	60.0
<i>Endamoeba histolytica</i> Schau.....	7	46.6
<i>Iodamoeba buetschlii</i> Prow.....	4	26.7
<i>Trichocephalus trichiurus</i> Linn.....	3	20.0
<i>Balantidium coli</i> Malm.....	1	6.7
<i>Giardia lamblia</i> Stiles.....	1	6.7
<i>Endolimax nana</i> W. & O'C.....	1	6.7

Since there was no epidemiological unit in the area, the wing surgeon designated the authors to make the examinations. It was a propitious time to begin the checking of employees, since the base was expanding rapidly with a corresponding expansion of native personnel. In addition, new bases were being commissioned, with similar problems existing in a portion of them. Over a period of many months, approximately 130 stool specimens were examined at Natal. Because of the loss of certain records, only 61 are included herein, in addition to those mentioned in table 1. It may be mentioned that blood smears for 30 of this group were checked for malaria, with 1 positive *P. vivax*. Practically all reported having had malaria when *Anopheles gambiae* was present at Natal.

Similar stool examinations were made for waiters at Pici' Field, Fortaleza, Aratu seaplane base, and Ipitanga Field, both the latter activities within 25 miles of Bahia and approximately 30 miles apart.

The data for the 133 examinations are presented in table 2. The parasites are listed, not in their biological order, but in order of their incidence at Natal, since the greater portion of the samples were taken at this point.

In the entire series, not a single parasite-free stool sample was observed. It should be borne in mind in examining the data in table 2 that the results were obtained without the use of concentration methods or examining more than one specimen from an individual. The groups sampled were somewhat higher in the economic scale than the day laborers reported in table 1. They lived in towns, where sanitary conditions were better and were less subject, probably, to hookworm attack since their vocation and environment necessitated the wearing of shoes, at least for a greater portion of the day. Thus, it is believed that our figures probably err conservatively for the entire population at the locations mentioned.

TABLE 2.—*Species and incidence of intestinal parasites at Natal, Fortaleza, and Bahia (Aratu and Ipitanga)*

Species	Natal (61 specimens)		Fortaleza (44 specimens)		Aratu (15 specimens)		Ipitanga (13 specimens)		Totals 133	
	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
<i>Necator americanus</i> Stiles.....	43	70.5	30	68.2	10	66.7	12	92.3	95	71.4
<i>Ascaris lumbricoides</i> Linn.....	30	49.2	28	63.6	14	93.3	10	76.9	82	61.6
<i>Trichocephalus trichiurus</i> Linn.....	26	42.6	18	40.9	13	86.7	6	46.2	63	47.4
<i>Endamoeba coli</i> Grassi.....	23	37.7	21	47.7	4	26.7	1	7.7	49	36.8
<i>Endamoeba histolytica</i> Schau.....	12	19.7	12	27.3	1	6.7	-----	-----	25	18.8
<i>Strongyloides stercoralis</i> Bavay.....	9	14.7	3	6.8	3	20.0	2	15.4	17	12.8
<i>Giardia lamblia</i> Stiles.....	3	4.9	1	2.3	-----	-----	-----	-----	4	3.0
<i>Iodamoeba buetschlii</i> Prow.....	3	4.9	6	13.6	-----	-----	1	7.7	10	7.5
<i>Endolimax nana</i> W. & O'C.....	3	4.9	-----	-----	-----	-----	1	7.7	4	3.0
<i>Schistosoma mansoni</i> Sanbon.....	-----	-----	1	2.3	2	13.3	3	23.1	6	4.5
<i>Trichomonas hominis</i> Dev.....	1	1.6	1	2.3	-----	-----	-----	-----	2	1.5
<i>Chilomastix meslini</i> Wenyon.....	-----	-----	1	2.3	-----	-----	-----	-----	1	.75

Hookworm had the highest incidence (71 percent) for the group as a whole, although at one location, Aratu seaplane base, *A. lumbricoides* was the most numerous. The latter species ranked second for the other locations and averaged 62 percent for all points. Forty-seven percent of all samples were infested with *T. trichiurus*. *E. histolytica* varied from zero at Ipitanga to 27 percent at Fortaleza. Incidentally, only at Ipitanga did we ever examine as many as 13 consecutive smears without discovering this species. *E. coli* infestations were approximately twice as numerous, 37 percent, as *E. histolytica*. *S. stercoralis* was present in nearly 13 percent of the samples. The remaining parasites,

with the exception of *I. buetschlii* (7.5 percent) were each represented by less than 5 percent of the total.

S. mansoni was never found at Natal (except in a Porto Rican serving in the Navy), although it was obtained at Fortaleza to the north, and Aratu and Ipitanga in the south. According to the local health authorities, this corresponds to the distribution of its snail host, *Planorbis*. The absence of the snail at Natal may be due to the much less favorable environmental conditions i. e. practically no lakes and ponds, while at the other locations such situations exist.

The series presented is admittedly a small one. However, it does represent a segment of conditions in four areas extending approximately 850 miles along the coast. The results obtained are believed to justify, adequately, the efforts of the Medical Department to enforce measures designed to prevent food and water contamination and to control, insofar as possible, the selection of food establishments for naval personnel when they were absent from their regular messes.

In closing, an example might be mentioned of the difficulties inherent in avoiding parasite ingestion in areas where the incidence is high. On an extended survey covering a number of bases, and despite more than ordinary care, one of the authors acquired both *E. histolytica* and *A. lumbricoides*. The source of all food eaten was the same. However, on several occasions the individual who acquired the parasites "took a chance" with a green salad composed of lettuce and tomatoes, which the other did not. In this connection, it was observed that long intervals without fresh, leafy vegetables will cause the normally cautious person to seek such food without questioning its origin.

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- Legge, Robert F.**, Captain (MC) USN (*A Statistical Review of 1,000 Orthopedic Consultations at a Naval Dispensary*, p. 827). B. A., University of California; M. D., C. M., McGill University Faculty of Medicine, 1930. Clinical clerk, St. Bartholomew's Hospital, London, England, 1930; intern, Peter Bent

Brigham Hospital, Boston, Mass., 1931, Southern Pacific General Hospital, San Francisco, 1931-32; assistant resident surgeon, 1932-33, and resident in orthopedics, 1933-35, Henry Ford Hospital, Detroit, Mich.; orthopedic house officer, Massachusetts General Hospital, Boston, Mass., and Children's Hospital, Boston, 1935-36; private practice, Oakland, Calif., 1936-41; staff, Alta Bates Hospital, Berkeley, Calif., Berkeley Hospital, Berkeley; and Highland-Alameda County Hospital, Children's Hospital of the East Bay, Peralta Hospital, and Providence Hospital, all at Oakland, Calif., 1936-41; clinical assistant orthopedic surgeon, University of California Medical School, San Francisco. Appointed assistant surgeon, USNR, 19 July 1935 from California; transferred to Regular Navy 18 July 1946. Served on U. S. S. *Curtiss* and U. S. S. *Thomas Jefferson*, and at U. S. Naval Air Station, San Diego, Calif., and U. S. Naval Hospital, Great Lakes, Ill. Fellow: American College of Surgeons and American Medical Association; member: American Academy of Orthopaedic Surgeons and Western Orthopaedic Association. Diplomate: American Board of Orthopaedic Surgery.

Lowe, Edward S., Captain (MC) USN (*Vagotomy in the Treatment of Peptic Ulcers*, p. 785). M. D., University of Colorado School of Medicine, 1929. Intern, Colorado Psychopathic Hospital, Denver, Colo., June 1928-June 1929; U. S. Naval Hospital, San Diego, Calif., July 1929-Aug. 1930. Appointed assistant surgeon, USN, 26 June 1929. Specialty: Pathology and surgery. Served at U. S. Naval Hospital, San Diego, Calif., U. S. Navy Convalescent Hospital, Asheville, N. C., U. S. Naval Hospital, Philadelphia, Pa., U. S. Naval Hospital, Long Beach, Calif., U. S. Naval Hospital, Canacao, P. I., and U. S. Naval Hospital, Alea Heights, T. H.; and on U. S. S. *San Francisco*, U. S. S. *Idaho*, U. S. S. *Henderson*, and U. S. S. *Palos*. Fellow: American College of Surgeons and American Medical Association.

MacCreary, Donald, Lieutenant Commander H(S) USNR (Inactive) (*The Incidence of Intestinal Parasites Among Civilians Employed at Certain Naval Air Bases*, p. 926). B. S., Iowa Wesleyan College, 1929; M. S., University of Maryland, 1930. Teaching fellow, University of Maryland, 1929; research fellow, 1930-31 and associate entomologist 1939-, University of Delaware. Appointed lieutenant, H(S) USNR, 17 Feb. 1942. Specialty: Economic entomology with special reference to insects affecting man and animals. Served as malarial control officer, Fleet Air Wing 16. Released from active duty 5 Nov. 1945. Member: American Association of Economic Entomologists, American Association of Mosquito Control Workers, and Delaware Natural History Society.

Moorman, Warren W., Lieutenant (MC) USN (*Incidence of Palpable Lymph Nodes*, p. 821). B. A., University of Texas 1940; M. D., University of Texas Medical Branch, 1942. Intern, Philadelphia General Hospital, Philadelphia, Pa., 1943. Appointed ensign, H-V (P) USNR 21 April 1942 from Texas; appointed assistant surgeon, USNR, 5 July 1943; transferred to Regular Navy 8 Nov. 1944. Specialty: Aviation medicine. Served on U. S. S. *General W. F. Hase* and at U. S. Naval Air Station, Dallas, Tex. Resigned 7 July 1947.

Mrazek, Charles, Lieutenant Commander (MC) USNR (*Improved Guillotine Operation and Retractor*, p. 892). M. D., Loyola University School of Medicine, 1934. Intern, St. Anthony de Padua Hospital, Chicago, Ill., 1934-36; prison surgeon, House of Correction, Chicago, Ill., 1936-43; private practice,

Berwyn, Ill., 1937-; clinical instructor in urology, Loyola University School of Medicine, 1941-; urological staff, St. Anthony de Padua Hospital, Chicago, Ill., 1937-; consultant, Chicago State Hospital, 1941-43; visiting staff, St. Anne's Hospital, Chicago, Ill., 1941-43. Appointed passed assistant surgeon, USNR, 1 Jan. 1943 from Illinois. Served on U. S. S. *Abbot* and at U. S. Naval Hospital, Chelsea, Mass. Member: American Medical Association, Chicago Medical Society, and Chicago Urological Society.

Patterson, John B., Lieutenant Commander (MC) USNR (Inactive) (*Reconstruction of the Thumb*, p. 880). M. D., University of Michigan Medical School, 1936. House officer, general surgery, July 1936-July 1938, and assistant resident, genito-urinary surgery, July 1938-Jan. 1939, Boston City Hospital, Boston, Mass.; house physician, Boston Lying-in Hospital, Boston, Mass., Feb. 1939-Sept. 1939; assistant resident, Free Hospital for Women, Brookline, Mass., May 1940-Nov. 1940; junior attending staff, plastic surgical service, Baylor University Hospital, Dallas, Tex. Appointed assistant surgeon, USNR, 28 Oct. 1942 from Illinois. Served in the Southwest Pacific Theatre and at U. S. Naval Hospital, Great Lakes, Ill. Released from active duty 24 Jan. 1946. Member: American Medical Association, Texas State Medical Society, and Dallas County Medical Society.

Schlack, Carl A., Commander (DC) USN (*Tests on the Prevention of Fracture of Glass Containers Due to Freezing of Their Liquid Contents*, p. 857). D. D. S., The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1929. Private practice, 1929-34; instructor in oral histology, histopathology, and comparative odontology, The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1931-36; lecturer, dental hygienist classes, 1933-36; research fellow, Pennsylvania College of Dental Surgery, 1934-36; associate professor in oral hygiene, School of Dentistry, Georgetown University, 1941 and 1942. Appointed lieutenant, junior grade (DC) USN, 11 Apr. 1936. Specialty: Oral pathology, dental research. Served at U. S. Naval Dental School and Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md.; on U. S. S. *Wisconsin*; and U. S. S. *Houston*. Fellow: American Association for the Advancement of Science; member: International Association for Dental Research, American Dental Association, and American Academy of Oral Pathology.

Schwab, Robert S., Commander (MC) USNR (*Psychiatric Data Compiled at a United States Naval Personnel Separation Center*, p. 830). A. B., Harvard College, 1926; M. A., St. John's College, Cambridge University, 1929; M. D., Harvard Medical School, 1931. Intern, Boston City Hospital, Boston, Mass., 1931-34; assistant neurologist, Washington University, St. Louis, 1934; resident neurologist, Massachusetts General Hospital, Boston, Mass., 1935; assistant neurologist and director, Brain Wave Laboratory, Massachusetts General Hospital; instructor, neurology, Harvard Medical School, 1937-. Appointed passed assistant surgeon, USNR, May 1936 from Massachusetts. Served at U. S. Naval Hospital, Chelsea, Mass., and overseas in the Pacific Theatre, and with U. S. Naval Base Hospital No. 6 and Fleet Hospital No. 103. Fellow: American Medical Association; member: American Neurological Association, American Psychiatric Association, Eastern Association of Electroencephalographers (president), American Society of Electroencephalographers (secretary), and Association for Research in Nervous and Mental Disorders. Diplomate: American Board of Psychiatry and Neurology.

Shelesnyak, Moses C., Lieutenant Commander H(S) USNR (Inactive) (*The Story of Elisha Kent Kane, Surgeon, U. S. Navy*, p. 861). B. A., University of Wisconsin, 1930; Ph. D., Columbia University, 1933. Fellow, Columbia University, 1932-33; student, Columbia University College of Physicians and Surgeons, 1933-35; instructor in physiology and pharmacology, Chicago Medical School, 1935-36; research associate, Mount Sinai Hospital, New York, N. Y., 1936-40; General Education Board fellow in child study (work carried out under Dr. McFarland, Columbia University), 1936-38; dean of boys, Academy, New York Association for the Care of Jewish Children, 1938-40; research fellow, Friedsam Foundation in Child Neurology, Beth Israel Hospital, New York, N. Y., 1940-42. Appointed lieutenant, junior grade, H (S) USNR, 7 Apr. 1942. Served at U. S. Naval Air Station, Pensacola, Fla., U. S. Naval Air Station, San Diego, Calif., and U. S. Naval Medical Research Institute, Bethesda, Md. Released from active duty 1 Aug. 1946. Member: Aero-Medical Association of the United States, American Association for the Advancement of Science, American Chemical Society, Association for the Study of Internal Secretions, Institute of the Aeronautical Sciences, and Society for Research in Child Development.

Silverstein, Charles M., Lieutenant, junior grade (MC) USNR (*Poliomyelitis: Study of an Epidemic of Forty Cases, Key West, Fla. (May-August 1946)*; Part I, p. 910). B. A., Emory University, 1941; M. D., Emory University School of Medicine, 1945. Appointed ensign, H-V (P) USNR, 15 Oct. 1942; apprentice seaman, V-12 (S), USNR, May 1943; appointed assistant surgeon, USNR, 6 Mar. 1945. Intern, U. S. Naval Hospital, Key West, Fla., June 1945-March 1946. Served at U. S. Naval Hospital, Dublin, Ga.

Solomon, Philip, Commander (MC) USNR (Inactive) (*The Diagnosis of Combat Fatigue*, p. 850). B. S., Harvard University, 1926; M. D., Harvard Medical School, 1930. Resident neurologist, Boston City Hospital, 1932-33; assistant in neurology, 1932-33, Austin teaching fellow in neuropathology, 1933-34, and in neurology, 1934-35, and assistant in neurology, 1936-, Harvard Medical School; junior visiting neurologist, Boston City Hospital, 1935-; assistant physician, Boston Psychopathic Hospital, 1935-36; assistant psychiatrist, Massachusetts General Hospital, Boston, 1935-36; research assistant in psychology, Brown University, 1936-37; senior psychiatrist, Massachusetts Department of Mental Health, 1937-38; psychiatrist, Habit Clinic for Child Guidance, Boston, Mass., 1937-41; consulting psychiatrist, New Hampshire Children's Aid Society, 1937-41; instructor in psychiatry, Tufts College Medical School; junior visiting neurologist, Beth Israel Hospital, Boston, 1938-41. Appointed passed assistant surgeon, USNR, 14 Feb. 1941. Served at U. S. Naval Training Station, Newport, R. I., and with the Sixth Marine Division in the field. Released from active duty 11 Apr. 1946. Member: Los Angeles County Medical Association. Diplomate: American Board of Psychiatry and Neurology and National Board of Medical Examiners.

Stewart, Daniel N., Jr., Lieutenant (MC) USNR (Inactive) (*Infectious Mononucleosis*, p. 889). A. B., Duke University, 1931; M. D., University of Pennsylvania School of Medicine, 1935. Intern, 1935-37, and resident, 1937, Hospital of the University of Pennsylvania; private practice, general medicine, and staff, Hickory Memorial Hospital, Hickory, N. C., 1937-42, and 1945-. Appointed assistant surgeon, USNR, 30 July 1942 from North Carolina. Served with an amphibious landing craft in South Pacific Theatre. Released from active duty 6 Sept. 1945. Member: American Medical Association and Medical Society of the State of North Carolina.

Vesey, John M., Lieutenant, junior grade (MC) USNR (*Rheumatic Fever in the Negro*, p. 805). B. S. Providence College 1942; M. D. Jefferson Medical College of Philadelphia, 1945. Appointed ensign, H-V (P) USNR, 15 April 1942; enlisted as apprentice seaman, V-12 (S) USNR, 1 July 1943; appointed assistant surgeon, USNR, 15 May 1945. Intern, U. S. Naval Hospital, Dublin, Ga., 1 yr. Served at U. S. Naval Hospital, Dublin, Ga.

Wickstrom, Otto W., Captain (MC) USN (*Reconstruction of the Thumb*, p. 880). B. S., Indiana University; M. D., Indiana University School of Medicine, 1927. First appointed assistant surgeon, USN, 6 June 1927; reappointed assistant surgeon, USN, June 1930. Specialty: Otolaryngology and general plastic surgery. Intern, U. S. Naval Hospital, Norfolk, Va., 1927-28. Served as chief, department of otolaryngology and ophthalmology, U. S. Naval Hospital, Philadelphia, Pa., and department of otolaryngology and general plastic surgery, U. S. Naval Hospital, Great Lakes, Ill. Fellow: American Academy of Otolaryngology and ophthalmology. Diplomate: American Board of Otolaryngology.

Willcutts, Morton D., Rear Admiral (MC) USN (*Care of Dependents in the Navy*, p. 777). B. S., Indiana University, 1914; M. D., Indiana University School of Medicine, 1916. Intern, Indianapolis City Hospital, Indianapolis, Ind., 1916-17. Appointed assistant surgeon, USNRF, 6 Apr. 1917 from Indiana; transferred to Regular Navy, 23 June 1917. Specialty: Surgery. Served at U. S. Naval Hospital, San Diego, Calif. (officer in command); with the Fifth Fleet and the Pacific Fleet; and Assistant Chief of Bureau of Medicine and Surgery for Professional and Personnel Operations, 1947-. Fellow: American College of Surgeons. Diplomate: American Board of Surgery.

Zeligs, Mendel, Commander (MC) USNR (Inactive) (*Intradermal Tests With *Dirofilaria Immitis* Extract in Human Filariasis*, p. 824). B. S., University of Cincinnati, 1920; M. D., University of Cincinnati College of Medicine, 1922. Intern, June 1922-July 1923, assistant resident in pediatrics, July 1923-July 1924, and chief resident in pediatrics, July 1924-July 1925, Cincinnati General Hospital, Cincinnati, Ohio; postgraduate study, University of Vienna, summer of 1932; instructor in pediatrics, University of Cincinnati College of Medicine, 1925-; staff, Cincinnati General Hospital, Cincinnati, Ohio; senior attending physician, Jewish Hospital, Cincinnati, Ohio; private practice, pediatrics, Cincinnati, 1925-42. Appointed surgeon, USNR 7 Sept. 1942 from Ohio. Served at Great Lakes Naval Training Station, McIntire Dispensary, U. S. Naval Hospital, Aiea Heights, Oahu, T. H., and U. S. Naval Hospital, San Diego, Calif. Released from active duty 18 Sept. 1946. Member: American Academy of Pediatrics, Cincinnati Pediatric Society, Cincinnati Academy of Medicine, Ohio State Medical Society, and American Medical Association. Diplomate: American Board of Pediatrics.



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COVER PHOTOGRAPH

The cover picture shows a scene in a naval outpatient clinic. The extent of medical care to dependents of naval personnel is shown by the fact that in 1 month in 1947 there were over 140,000 outpatient visits and examinations, almost 4,800 hospital admissions, and 1,500 babies delivered by naval medical officers. In this picture Lt. Willard B. Rew (MC), U. S. N. R., pediatrician, examines Wayne Dyer at Oakland Naval Hospital.

TABLE OF CONTENTS



	Page
PREFACE	III
NOTICE TO CONTRIBUTORS	IV

SPECIAL ARTICLES

Dual Perforated Peptic Ulcer — <i>Luther G. Bell, J. Cuthbert Owens, and William J. MacMurtrie, Jr.</i>	937
Bladder Management Following Spinal Injury — <i>Leslie L. Veseen, William W. Miller, Jr., and Gilman C. Paynter</i>	945
Removal of Ureteral Calculi by Catheter Traction With Report of Three Cases — <i>Jacob J. Robbins</i>	954
Renal Decapsulation in the Treatment of Oliguria and Anuria — <i>Edward S. Lowe</i>	959
Yaws Treated With Single Massive Doses of Penicillin — <i>Sidney L. Arje</i> ..	965
Extragenital Primary Syphilis — <i>L. Keith MacClatchie</i>	970
Arachnidism, With Report of a Case — <i>Dallas E. Billman</i>	975
A Review of Neurosyphilis — <i>Robert E. Rock and Edward F. Mee</i>	983
Management of Wounds and Wound Healing — <i>Thomas C. Ryan</i>	991
Experiences of a Medical Officer in the Air Transport of Patients by the Naval Air Transport Service — <i>Joseph P. Pollard</i>	1000
Sarcoma of the Soft Tissues; Discussion and Report of Eight Cases — <i>Arthur I. Holleb</i>	1005
Mucous Membrane Grafts From the Inferior Turbinate in Reconstruction of the Orbit — <i>Harry P. Schenck</i>	1014
Instrument Sterilization in Desert Country — <i>Clarence E. Dawson</i>	1019
Dental Inactivation in the Reserve Fleet — <i>Robert F. Erdman</i>	1022
Obstetrics on Guam — <i>Monrad E. Aaberg</i>	1027
A Review of the Physiology of Blood Coagulation and Its Relationship to Some of the Common Hemorrhagic Disorders; With Report of a Case of Unexplained Purpura — <i>Bruce L. Canaga, Jr.</i>	1037

EDITORIALS

	Page
50th Anniversary of the Establishment of the Hospital Corps.....	1045
Certain Statistical and Social Aspects of Diabetes.....	1045
The Physiological Clock.....	1047
One and One-Half Million Births in the United States in First Five Months.....	1047
Compulsory Exercise in Relation to Health.....	1048
Questionnaire on the Naval Medical Bulletin.....	1049
QUESTIONNAIRE.....	1051

CLINICAL NOTES

Recurrent Inguinal Hernia; Report of Two Unusual Cases—<i>Robert B. Brown and Lewis L. Haynes</i>.....	1053
Eosinophilic Granuloma of Bone, With Report of Two Cases—<i>Donald B. Hull and William M. Silliphant</i>.....	1058
Eosinophilic Granuloma of Bone—<i>Edgar N. Weaver and John R. Carter</i>....	1066
Extragenital Choriocarcinoma of the Male With Bilateral Gynecomastia; Report of a Case—<i>Henry J. Caes and Richard W. Cragg</i>.....	1072
Methyl Salicylate Poisoning; a Report of Two Cases and Review of the Literature—<i>Jesse J. Cancelmo, Jr</i>.....	1077

MEDICAL AND SURGICAL DEVICES

Preservation of Museum Specimens in Plexiglas—<i>Russell H. Walker</i>.....	1086
--	------

BOOK NOTICES

Occupational Diseases of the Skin, <i>Schwartz, Tulipan, and Peck</i>—<i>Insect Microbiology, Steinhaus</i>—<i>The Compleat Pediatrician, Davison</i>—<i>Methods of Diagnosis, Clendening and Hashinger</i>—<i>Textbook of Biochemistry, Harrow</i>—<i>Practical Pedodontia or Juvenile Operative Dentistry and Public Health Dentistry, Hogeboom</i>; special chapters by <i>Anderson, Hawkins, Hyatt, and Straub</i>.....	1089
--	------

PREVENTIVE MEDICINE

Toxic Reactions in the Treatment of Syphilis in the U. S. Navy in 1946..	1095
Poliomyelitis: Study of an Epidemic of Forty Cases, Key West, Florida (May–August 1946); Part II—<i>William D. Davis and Charles M. Silverstein</i>.....	1102
NOTES ON CONTRIBUTORS.....	1111
INDEX.....	1119





Fellow Officers of the Medical Department:

It was the first Chief of the Bureau of Medicine and Surgery, W. P. C. Barton, who, during his term of office from 1842 to 1844, established a medical library in all medical units of the Navy. This act and the policy instituted is an example of real medical statesmanship. The consequences were most far-reaching. The idea of the necessity for the best medical literature to be readily available to the naval surgeons became firmly implanted. Our fine medical libraries in naval hospitals, on hospital ships, and the many thousands of dollars spent annually for medical books and medical journals are the result of this policy established by Dr. Barton.

There is a direct connection between the habitual use of medical books and medical and scientific periodicals and the results in the treatment of patients. It is absolutely necessary to be abreast of recent developments in all fields of medicine if we are to bring the best treatment to the bedside. In this, our medical libraries are one of the best tools of our craft.

These libraries may be large, as in our large hospitals, or be on a shelf or two in the sickbay of a small ship, but it is always a contact with the best professional authorities. The fine results in the treatment of the sick and injured in peace and war attained by the Medical Department of the Navy has been in part due to this ready access to medical literature as a result of the far-sighted medical statesmanship of Dr. Barton and the continuing support to medical libraries in the Navy by the Surgeons General who followed him.

Sincerely,

A handwritten signature in dark ink, reading "C. J. Swanson". The signature is written in a cursive style with a large, prominent "C" and "S".

Rear Admiral, Medical Corps,
Surgeon General, United States Navy.

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*"Limited to Professional Matters as Observed by Medical Officers at Stations and on Board Ships in Every Part of the World, and Pertaining to the Physical Welfare of the Naval Personnel"*¹

SPECIAL ARTICLES



DUAL PERFORATED PEPTIC ULCER AND DUODENAL FISTULA

LUTHER G. BELL
Captain (MC) U. S. N.

J. CUTHBERT OWENS
Lieutenant Commander (MC) U. S. N. R.

and

WILLIAM J. MACMURTRIE, JR.
Lieutenant, junior grade (MC) U. S. N. R.

The medical profession is well acquainted with the symptoms and signs of a perforated peptic ulcer. Surgeons are prepared at operation to identify the leaking site and repair it as quickly and simply as possible. Then, following careful peritoneal toilet, the abdomen is closed as expeditiously as possible. However, dual perforations can and do occasionally occur, as attested by the case presented; and the surgeon, in his desire to perform a rapid and simple repair, should never fail to carefully explore the stomach and duodenum for other defects in the intestinal wall.

Multiple perforations of single or multiple peptic ulcers are a rare but not unknown condition. Two or more ulcers have been variously reported as occurring in from 10 to 50 percent of cases (1). The usually accepted incidence is 15 percent (2). Dual perforations occur much less commonly. Bager, quoted by Pascalidis (1), reported a series of 1,767 cases of operated perforated ulcers in the *Acta Chirurgica Scandinavica*, and of these 9, or 1 in 200, had dual perforations.

¹ The policy of the U. S. NAVAL MEDICAL BULLETIN as printed on the cover of its first issue and maintained throughout the 40 years of its existence.

Masson and Simon (3) reviewed the literature in 1927 and found 32 cases, to which they added 1 of their own. In a review of reports since that time the authors have been able to find 6 cases in the American and 4 in the foreign literature. The present case brings the total to 44 (4) (5) (6) (7) (8) (9) (10) (11) (12). Most of these have been multiple perforations of a single ulcer. Significantly, since 1927, all except 1 reported case of dual perforation have recovered, while only 4 of the cases in Masson and Simon's collected series survived. They stated that rarely at surgery and usually at autopsy is the diagnosis of multiple perforations made, thus adding further emphasis to the need for careful inspection at the time of operation. Some of their cases had 3 or 4 perforations in a single large ulcer.

CASE REPORT

History.—White male; age 39; weight 145 pounds; admitted 31 May 1946.

Chief complaint.—Severe pain in epigastrium of 16 hours' duration.

Present illness.—Sixteen hours prior to admission the patient was seized with a sudden severe epigastric pain, constant and crampy in character. He felt weak and dizzy and then became nauseated, but did not vomit.

He gave a history of burning epigastric pain of 6 years' duration following meals, relieved by soda bicarbonate. This pain became more severe recently and during the past 3 months reached its peak of intensity, but with no previous attacks as severe as the present one. The patient had not eaten since the morning meal.

He was given morphine $\frac{1}{4}$ grain upon transfer to the hospital. The pain was relieved for about 1 hour, but while en route to the hospital a second seizure similar to the first one occurred.

Review of systems.—Essentially negative except for a tense easily worried individual who stated that he could not relax.

Past and family history.—Noncontributory except as given in present illness.

Physical examination.—Temperature 100.8° F.; pulse, 84; respiration, 24; blood pressure 135/78. The patient was a thin white male acutely ill and who appeared to be in severe pain. His skin was pale and he moved as little as possible.

The positive physical findings were confined to the abdomen which was scaphoid with boardlike rigidity and epigastric tenderness. No peristalsis was heard on auscultation. Rectal examination was negative. Flat plate of the abdomen was negative for air beneath the diaphragm.

Preoperative laboratory notes.—Red blood cells, 4,650,000; hemoglobin 90 percent or 13 grams. White blood cells 32,000; differential segments, 85 percent; bands, 6 percent; lymphocytes, 6 percent; monocytes, 2 percent. Coagulation and bleeding time were within normal limits. Urinalysis was negative except for a trace of sugar.

Preoperative diagnosis.—Ruptured peptic ulcer. General peritonitis, acute.

Operation was advised and accepted by the patient. Dextrose in normal saline was started immediately followed by 500 cc. of whole blood which was completed during the operation. Under spinal anesthesia the abdomen was opened through a high right rectus incision. The peritoneal cavity was found to contain a large amount of seropurulent fluid and undigested food particles.

The fluid was aspirated and a culture taken which was later reported negative. The lower end of the stomach, duodenum, gall bladder, transverse colon and greater omentum all showed evidence of a marked inflammatory reaction and were covered by a plastic exudate. Examination of the duodenum revealed a large ulcer approximately 3 by 2 cm. in diameter beginning just distal to the pylorus. There were two distinct perforations of the ulcer. One perforation 3 mm. in diameter was located on the superior margin of the duodenum in the most distal portion of the ulcer and just below the hepato-duodenal ligament. The second perforation, also approximately 3 mm. in diameter, was just distal to the pylorus on the antero-inferior aspect of the duodenum. Both perforations were exuding duodenal contents. Three interrupted sutures of No. 00 chromic gut on an atraumatic needle were passed through the outer margins of the superior ulcer. An omental patch was turned down from the gastrohepatic omentum over the ulcer and the sutures tied closing the perforation. Similarly the second perforation was closed using an omental patch from the greater omentum. Closing the perforations by invagination sutures would have obstructed the duodenum.

Morison's pouch, the right colic gutter, and the pelvis were again aspirated obtaining additional seropurulent material. The general peritonitis present was most severe in the upper abdomen.

A Penrose drain was placed in Morison's pouch and the abdomen closed in layers in the usual manner. The patient left the operating room in good condition.

Summary of postoperative treatment and progress.—In addition to parenteral therapy of 3,000 cc. of intravenous fluids and vitamins daily the patient received 80,000 units of penicillin every 3 hours and morphine, $\frac{1}{4}$ grain, as necessary for pain. Wangensteen suction was started immediately postoperatively. On 2 June 1946 the progress of the patient was satisfactory, but when the dressing was changed it was found to be soaked with a dark green serous material. Dressing samples sent to the laboratory for examination were reported positive for serum amylase which, of course, was indicative of a complicating duodenal fistula of the lateral type. For the next 24 hours the drainage increased markedly with concomitant excoriation of the abdominal wall.

On 5 June 1946 a No. 12 catheter was passed along the Penrose drain into the abdominal cavity and connected to a Marsh precision pump (fig. 1). To neutralize the duodenal contents escaping around the catheter wet continuous dressings of $\frac{1}{1000}$ aqueous merthiolate solution were applied to the wound. For the next 12 days the duodenal drainage recovered by the Marsh precision pump varied from a maximum of 3,200 cc. to a minimum of 350 cc. daily. Thereafter there was a gradual diminution of the drainage with cessation on the twenty-first day of the fistula or the twenty-third postoperative day. During this period fluid and chloride balance were maintained. Special attention was paid to the serum proteins keeping them at a normal level by whole blood transfusion and parenteral amino-acids.

On the tenth postoperative day the Wangensteen suction was discontinued and a Sippy regime instituted which the patient tolerated without noticeable increase in the fistulous output. After the closure of the fistula the patient gained weight and strength rapidly. Gastro-intestinal studies on 12 August 1946 revealed a deformity of the duodenal cap, but no evidence of an ulcer crater or obstruction. He was discharged from the hospital on 4 September 1946 weighing 150 pounds, and completely asymptomatic. After discharge from the hospital the patient continued well during the 6 months' follow-up.



FIGURE 1.—Marsh precision pump in operation.

COMMENT

Attention is called to the second attack of epigastric pain occurring en route to the hospital and approximately 12 hours from the original onset of symptoms. This is thought perhaps to represent the time of the second perforation. The patient was sedated with morphine at the time of the exacerbation of his pain.

Of further interest in this case was the development of a post-operative duodenal fistula, the cause of which is purely speculative. The most plausible one is a blow-out of one of the previously repaired perforations; however, we may suggest a third perforation, which if it occurred was without clinical supporting evidence. No previous reference has been made in the literature to this condition complicating multiple perforations. As stated, this first appeared on the second postoperative day and was completely healed by the twenty-third day.

There are numerous reports on this condition in the literature (13) (14) (15) (16) (17) and of methods of treatment. Duodenal fistulae are usually divided into two types: the lateral, in which the continuity of the bowel is intact except for the fistula; and the "end" type, which results from leakage in the closed duodenal stump following gastric

resection. Bartlett and Lowell (13) collected and reported 128 cases of duodenal fistula. According to them the "end" type is less common and more benign, occurring in 14 of the 128 cases with 2 deaths. The lateral type occurred in 114 of their cases with a 40-percent mortality.

The main cause of fistula formation is trauma, either from surgery or improperly placed drains. Sepsis, hypoproteinemia, avitaminosis, and other general conditions are contributory causes. It is significant that the mortality from this complication has decreased with a better understanding of the chemical changes which occur in the body with prolonged loss of duodenal content, and with the development of adequate replacement therapy.

Onset of the fistula is usually sudden and before the fifteenth post-operative day, often occurring after the removal of a drain. The discharge is watery, alkaline, copious, and irritating, so that there is widespread and rapid digestion of the surrounding abdominal wall.

The objectives of treatment can be divided into local and systemic care. The latter is too well known to bear repetition here, but it is not amiss to call attention to the work of Coller et al. (19), who have pointed out the dangers of overloading the circulation with salt solution.



FIGURE 2.—Condition of skin on tenth postoperative day.

Various types of local care have been described, among them being constant suction applied to the fistula; chemical neutralization of the ferments with various substances; mechanical absorption of the discharge; protection of the surrounding skin with various gels (20); elimination of positive duodenal pressure by intubation; and jejunostomy for feeding and replacement of the collected drainage.

Of the procedures listed maintenance of constant suction on the fistula is of prime importance, especially as this keeps the wound dry and minimizes skin irritation and reaction (fig. 2). It also enables the draining contents to be gathered so that they can be re-fed to the patient. For this suction we used the Marsh precision pump, which is an automatic, intermittent suction apparatus, designed to cut off when the pressure exceeds 25 mm. of water. This safety factor is considered of extreme value in preventing injuries to structures such as mucosa and intestinal wall in contact with the suction tip.

For further skin protection a $\frac{1}{1000}$ aqueous solution of merthiolate was employed, which neutralized the alkaline discharge and effectively protected the surrounding abdominal wall from irritation of any kind. This was applied by simply soaking gauze packs in the solution and applying them about the fistula. These dressings were resaturated every 2 or 3 hours.

Wangensteen suction was maintained during the early course of the fistula, and this greatly reduced the intraduodenal pressure, as was evidenced by the increased fistular drainage when the tube was clamped. However, this was discontinued after 10 days as the suction pump was easily able to handle the smaller volume of fluid issuing from the diminishing fistula.

Jejunostomy was not performed, nor was the drainage re-fed to the patient, since his course was sufficiently good to make these unnecessary. However, the former is often the only method by which sufficient fluids and electrolytes can be given in time to counteract a fatal acidosis. Bartlett and Lowell (13) feel quite strongly that a jejunostomy performed at the right time may make the difference between a recovery or fatality in cases of this condition.

SUMMARY

1. A case of dual perforation of a duodenal ulcer with subsequent development of a duodenal fistula has been presented.
2. The literature of multiple perforations has been reviewed and this present case brings the total reported to 44.
3. Types of duodenal fistula are reviewed and accepted methods of treatment outlined.

4. The use of $\frac{1}{1000}$ aqueous solution of merthiolate as a method for neutralizing duodenal contents protecting the surrounding skin was very effective and further trial is recommended in similar cases.

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BLADDER MANAGEMENT FOLLOWING SPINAL INJURY

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The chief causes of the high morbidity following spinal-cord injury are the genito-urinary complications. There is no set of rules to be followed. Each case should dictate its own needs. As yet this problem is far from being completely settled.

During the last year there has been a considerable volume of literature presented concerning the "cord bladder," advocating a variety of methods of handling such cases. Confusion and disagreement exists among well-qualified urologists regarding this problem. Nothing original is claimed in the following presentation. It is more or less a brief résumé of how large series of such problems was handled with gratifying results.

The anatomy and physiology of the bladder-emptying mechanism are not completely understood. Theories rise and fall. From these certain important factors have been established.

The detrusor muscle is composed of involuntary muscle fibers spatially arranged to provide for contraction around the vesical orifice (17), which is relaxed, or opened concurrently. Circular and longitudinal fibers are arranged in a greater mass at the bladder neck, being interlaced and diverted from their usual course (23).

The external sphincter is composed of the deep transverse perineal muscles (4) (5), but is not thought to be well designed for withholding urine. It is a voluntary muscle and unable to maintain constant exertion without fatigue.

No one has been able to demonstrate conclusively the presence of a true, distinct, internal bladder sphincter. However, the external sphincter and internal sphincter (if such a structure exists) under normal conditions are adequate to provide for urine control.

¹ Resigned 28 April 1947.

The nerve supply to the bladder comes from three sources (12) (9). The hypogastric plexus carrying the thoracolumbar sympathetic outflow (presacral nerve) divides anterior to the sacrum into the right and left pelvic plexuses. From these plexuses sympathetic stimulation reaches the bladder. A considerable amount of experimental and clinical work on the effect of stimulating or inhibiting this supply indicates that its effect on bladder emptying is minimal. Histologically, sympathetic nerve terminations on bladder musculature have not been observed. They have been studied in animals by the use of Cajal's method of silver staining. Lightly stained postganglionic sympathetic fibers were seen to run with intensely stained postganglionic parasympathetic nerves. The latter's terminations on detrusor fibers were easily visualized. Work on cats, whose pelvic nerves had been cut, demonstrated a temporary contraction followed by prolonged inhibition after presacral faradic stimulation (15). It was deduced that the sympathetic supply was slightly greater than that necessary for blood-vessel control and that the sympathetic nerves maintained detrusor tone. The effects of presacral neurectomy for the relief of bladder pain or in an attempt to increase detrusor contraction have been chiefly unsuccessful. After 10 years' observation in a select group in which the operation was performed, Jacobson, Braasch, and Love (14) decided that no permanent effect could be noted. It is now thought that the sympathetics have very little effect on the emptying mechanism. Their chief terminations are thought to be on bladder blood vessels and any effect of their obliteration is due in part to circulatory change and is transitory.

The parasympathetic nerve supply comes from anterior and posterior nerve roots of the second, third, and fourth sacral segments. These fibers meet to form the pelvic nerve or *nervi erigentes*. This nerve enters the bladder with the pelvic plexuses. The parasympathetics are almost wholly responsible for bladder emptying. Experimental stimulation of these roots results in prompt contraction. Afferent impulses responsible for the sensations of distention and the desire to void are transmitted, in all probability, through the dorsal nerve roots of the pelvic nerves.

A perineal branch of the pudendal nerve innervates the voluntarily controlled external sphincter. The external sphincter is sometimes of necessity employed as the one vesical sphincter. Usually, in those cases there is considerable urgency (16).

Normal voiding occurs, in the absence of central inhibition, through a reflex whose relay center is located in the conus medullaris. This type of voiding is observed in infants. The reflex is started by an increase in bladder pressure above 12 mm. of mercury. Afferent impulses travel in the dorsal pelvic nerves to the conus medullaris. Through a reflex arc the emptying stimulus then travels to the bladder

through the afore-mentioned anterior roots of the second, third, and fourth sacral nerves. The fact that the entire relay center is supposedly contained in as small an area as one corresponding to portions of the twelfth thoracic and first lumbar vertebrae indicates the difficulties that may ensue by trauma to that area.

The action of the trigone has undergone dispute in recent years. It is innervated, along with the prostate and seminal vesicles, by the presacral nerve. The premise previously held that it is actively involved in bladder emptying has been challenged. Young was the first to describe the action of the trigone seen through the cystoscope when the patient voids. Its contraction is plainly seen. However, further experimentation has shown that loss of its action by presacral neurectomy results only in sterility due to failure of the ejaculate to be propelled out of the urethra. It passes into the bladder instead. Lewis (17) believes that its chief action is sexual and that its contraction, in the absence of detrusor contraction, prevents seminal backflow.

Central inhibition of the micturition reflex stems from centers in the cerebral cortex which have not been accurately localized. These centers normally exert a constant inhibitory tone on the detrusor that keeps us dry. When the pressure of distention enters our consciousness, and if the time is not convenient, an increased inhibitory outflow relaxes the detrusor and lowers the intravesical pressure, so that the desire to void is lost for awhile. Everyone is familiar with this phenomenon. If these centers are destroyed or damaged, incontinence is the usual result. Evans (9) postulates that the paracentral lobule is the chief controlling center in the brain. Lewis describes a patient with a left-sided brain lesion and a right hemiplegia. He suffered incontinence. Lewis feels that similar lesions on the opposite side of the brain do not have a similar effect (17).

In summary, the detrusor is the chief muscle involved in micturition. Impulses acting through parasympathetic fibers carried in the second, third, and fourth sacral nerves and spinal centers in the conus medullaris provide the micturition reflex which is inhibited centrally.

The effects of various nervous system lesions on the bladder produce varying clinical pictures.

The effects on the bladder musculature are those resulting from distention atrophy. The wall of the bladder becomes thin and shows early fine trabeculation which is not diagnostic. Emmett and Beare (8) describe coarse trabeculations and hypertrophy in a series of tabetics they examined, stating that the cystoscopist, who has not observed this, is of limited experience. The authors did not observe this in a series of traumatic cord bladders. Bladder volume increases tremendously and tone and force of expulsion are decreased.

With a conus medullaris tumor, sensation may be retained. A 29-year-old seaman, first class, entered the hospital with the chief complaint of increasing inability to urinate with its attendant distress. A conus medullaris tumor was removed and voluntary voiding returned. With the spinal cord trauma, the diagnosis is more difficult.

Immediately following injury the well-known state of spinal shock ensues. In this period it is usually impossible to diagnose the type of bladder function that will result. The usual finding in this period is a bladder that will refuse to empty except by the phenomenon of overflow incontinence. This is a purely mechanical spilling of urine due to stretching of the vesical neck. In this connection, it may be mentioned that spontaneous bladder rupture in these cases is unknown as far as the authors can determine in a search of the literature.

This stage, so far as the bladder is concerned, usually lasts from 2 to 5 days. At the end of this time, one of two frequently described conditions will occur. With lesions at the conus medullaris corresponding to the twelfth thoracic and first lumbar vertebrae the reflex arc is broken. Bladder contractions are autonomous. The bladder is characterized by frequent weak contractions and a large amount of residual urine is present, much like that seen in multiple sclerosis and *tabes dorsalis* (8) (19). Overflow incontinence and the weak autonomous bladder contractions produce frequent small spurts of urine that keep the patient wet. The residual urine predisposes to infection.

With lesions at a higher level, the bladder function more nearly approaches normal. The bladder tone is again increased and there is still residual urine, but the amount is less. The reflex arc permits more forceful contractions and more efficient ones, with the patient remaining dry between expulsions. The patient can frequently decrease the residual urine by active suprapubic compression and increasing intra-abdominal pressure. This state can be compatible with a normal existence.

Between the automatic bladder and that contracting autonomously are many variations combining features of each type of action. The functional result will vary between constant spilling of urine and a bladder that can empty itself every 1 to 2 hours and keep the owner dry between times.

Hypertrophy of the musculature surrounding the vesical orifice following the late "detrusor hypertrophy" response and spasm, with its resultant partial obstruction, is a frequent finding following spinal cord trauma regardless of the type of bladder function that results (6) (7) (8) (21) (22).

In the management of a patient with traumatic injury to the spinal column and neural elements, the closest cooperation of the orthopedic surgeon, neurologist, and urologist is necessary. At no time should the patient be lost sight of.

The ultimate aim of the urologist is to assist nature in producing the return of normal bladder function or the closest alternative, the automatic bladder.

As can readily be seen from the previous discussion of the neural anatomy of the bladder, the level of the spinal injury may be used as a guide in prognosticating the final result. Generally, those below first lumbar, involving the bladder nerves, hold the poorest urological prognosis.

The first 48 hours following spinal injury is considered a crucial period by the urologist, for the reason that the management of the bladder disturbance during this time may have a permanent influence on the entire urological care of the case. No didactic set of rules may be laid down; there are too many variable factors to consider. The department of urology has tended toward extreme conservatism and watchful expectancy in handling the cord bladders which have come under its care.

When the case is seen immediately, the bladder is permitted to become distended. Catheterization is delayed as long as possible. It is common knowledge that the normal bladder musculature will not rupture spontaneously from such dilatation. Paradoxical incontinence will take care of this. At this time the urine is sterile, but imminently infectable because of stasis. There is nothing new about this. During World War I the noncatheterization program was promulgated as a general order, advocated by the late Dr. H. H. Young (24).

Cooperation of the patient, fluid intake, degree of vesical distention, and development of septic symptoms are all to be considered in the management of such a problem.

First, the patient is instructed to attempt to empty the bladder at periodic intervals by the clock. In the very beginning this interval may be as short as every 30 minutes. Gradually, it is increased until the interim between voidings is in the neighborhood of 2 to 3 hours. The accessory muscles of micturition, namely, the recti, obliques, and transversi of the abdomen and the diaphragm are utilized if possible. In addition, suprapubic pressure exerted with the closed fists is advised if the upper extremities are not involved in the injury. If such is the case, an attendant accomplishes the Credé maneuver. Complete emptying of the bladder will be impossible; a residual urine will be present and will act as an excellent culture medium for pathogenic organisms.

Antibiotic and chemical agents are administered from the moment the patient is seen (20). Penicillin is given in large doses, 40,000 units and up, every 3 hours. Streptomycin is reserved until complications develop because of its scarcity and the fact that organisms

are capable of developing considerable resistance to it (1). Infected cord bladders head the list of urological disorders for which this particular material is indicated. When administered, 0.4 gram is given intramuscularly every 6 hours. The sulfa drugs are administered in an acid medium and are effective. The dosage rarely exceeds 4 grams in 24 hours. Methenamine, mandelic acid, and mandelamine are also available.

Acidification of the urine is carried out with one of the following drugs: (1) Ammonium chloride, (2) ammonium nitrate, (3) ammonium mandelate, and (4) sodium acid phosphate. The acid-ash or ketogenic diet is utilized.

The acidification of the urine serves two functions. It produces an undesirable culture medium for the growth of *E. coli*, the most troublesome pathogen encountered, and assists in maintaining carbonates and phosphates in solution, staving off the development of urinary calculi, resulting from the mobilization of the skeletal salts during a protracted period of bed rest.

Careful observation of the chemical environment of the patient must be carried out. Urine acidity is checked daily; laboratory examination of the urine is carried out daily. The carbon dioxide combining power is checked periodically. The production of acidosis may be a serious problem in itself.

Acetyl beta-methylcholine (11) may be used initially because of its parasympathimometric action (13). Very little may be expected from its use, but occasionally its action will assist detrusor contractions (10). By its proper use the postoperative bladder atony may be completely controlled, obviating the need for catheterization. Oral doses up to 300 milligrams every 3 to 6 hours or parenteral doses up to 150 milligrams are employed. Atropine sulfate should be readily available to control and abolish its actions if the need arises.

During the first 5 days automaticity may develop. This is well illustrated by one of the cases under the management of the authors. Almost complete paralysis of the lower extremities followed the administration of a spinal anesthetic. The patient was seen immediately and put on the above regime. Except for one well-meant, but ill-advised catheterization, the above program was carried out with very gratifying results. The urine did not become infected.

Such is not always the happy state of affairs. Unconsciousness and upper extremity paralysis may interfere and preclude parts of the program.

Catheterization may finally have to be done. The rapidity of decompression of the bladder is still controversial. No harm is done in completely emptying the bladder in acute distention.

Slow decompression is advised if the distension is of long standing. If, after the second catheterization, more are needed to promote drainage an indwelling urethral catheter should be placed. The Foley type catheter is the easiest to use, but the latex rubber predisposes to the accumulation of crystal deposits upon itself. A properly taped, soft, plain rubber catheter is perfectly satisfactory (17). Proper catheter care is required (urine acidification, frequent irrigations with a buffered citrate solution, and frequent changes with the strictest of aseptic technique at 5- to 10-day intervals.) A catheter clamp for periodic drainage is used. At each catheter change the development of automaticity is checked. The complications attendant to the urethral catheter are: Urethritis, decubiti of the urethra, periurethral abscess, prostatic abscess, and cystitis. After 5 to 10 weeks of such drainage, tidal drainage after Munro may be instituted (18). The buffered citrate solution formerly mentioned is used in the siphon outfit as an irrigating medium. By gradually increasing the pressure as tonicity returns, automaticity may develop. Munro originally described four stages of progress to this end: (1) 2 to 5 centimeters of water pressure; (2) 10 to 15 centimeters (normal consciousness of a full bladder lies in this range), (3) 20 to 30 centimeters, and (4) automatic emptying and reeducation dispensing with the apparatus.

Finally, after a lapse of several months or the development of complications (infection, sepsis, reflux ureteral flow, hydro- and/or pyonephrosis) a temporary suprapubic cystotomy may be done. The suprapubic tube must be handled with the same care as an urethral catheter. However, all conservative means are first exhausted and the patient is completely reevaluated by the orthopedic surgeon, neurologist, and urologist before any radical treatment is undertaken. This was necessary in one case. The wound subsequently closed and the patient began to walk with aids and the hydronephrosis resolved completely.

Transurethral resection of small amounts of tissue from the bladder neck of cord bladders has been popularized during the war years. It was first employed in tabetic patients in 1935 (19). Nesbit describes the tissue removed from the above patients as normal smooth muscle. Removal of the "hypertrophic" neck is supposed to promote urine drainage, do away with straining and residual urine, yet leaving the patient continent with good control. The patients under the care of the authors who have had transurethral resections in other hospitals were incontinent, necessitating a penis clamp. It is felt that the transurethral resection should be done late in the management of these cases (2) (3) (6) (7) (8) (21) (22). That does not infer that cystotomy is not to be done. Indications for it may develop at any time during the management of these cases.

The above may not suit the needs of all the consultants concerning themselves with such cases, however, the program is worthy of a trial. Many reflexes may develop after the initial spinal shock wears off and skeletal decompressions are accomplished. No part of the program is done to facilitate plaster casting—the patient comes first!

SUMMARY

1. Anatomy and physiology of the urinary bladder are presented as related to the pathology and patho-physiology resulting from spinal cord injury.

2. A program of management has been outlined which is successful in the experience of the authors.

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REMOVAL OF URETERAL CALCULI BY CATHETER TRACTION

With Report of Three Cases ¹

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Instruments for extraction of stones from the ureter have had a long history since Dr. Hugh Young first succeeded in 1902 in inducing a ureteral calculus to pass by poking and prodding with instruments by way of the newly invented cystoscope. The passage of 40 years has provided the urologist with a large number of ingenious instruments and an array of vastly improved cystoscopes to manipulate stones. However, that urologists vary considerably in estimate of their worth is evidenced by the following quotations from the literature.

C. B. Squire, of the Crowel Clinic, reporting on cases treated between 1915 and 1930 states, "Manipulation was successful in 528 cases. Only 44 required open operation." In contrast there is Higgins' review of 350 cases of ureteral calculi in which treatment was given at the Cleveland Clinic. Manipulation failed or was not attempted in 228 cases. Livermore, an inventor of one of the early instruments, stated in 1941, "I want to go on record as condemning all metal instruments for promoting the removal of stones in the ureters."

Everyone experienced in the use of the cystoscope has wished for an instrument with which he might easily and safely grasp a calculus and pull it out of the ureter. However, because of certain difficulties attending the use of forceps on the human ureter no dependable instruments have ever been devised. Briefly the difficulties are these:

1. A useful forceps must be rugged in construction with strong serrated jaws. Yet it must be small and have a semiflexible shaft.
2. Since the forceps must grasp the stones blindly some provision must be made to prevent inclusion of the mucosa of the the ureter.
3. Granted that these difficulties are overcome the discouraging fact remains that only very small calculi can be pulled through the ureter.

¹ Since submitting this article the author has treated four additional cases of ureteral stone by this method.

Finney, in 1941, first reported a method which appears to overcome these obstacles and was successfully used by him in 50 cases. The author has followed his technique in 3 cases with excellent results. Briefly it consists in looping a catheter around the stone in the ureter and removing it by traction. This method has the following advantages:

1. In contrast to older methods only one cystoscopy is usually required.
2. It is practically free of danger.

The technique as described by Finney is as follows: A No. 6F catheter is modified by inserting a suture in the distal end, being careful to tie the knot as small as possible. I have obviated the need of knotting the suture by using a double length and leaving both ends long.

A wire stilet should be inserted to stiffen the catheter which is then passed to the stone and beyond. If difficulty is encountered in passing the stone a local anesthetic injected through the catheter will relieve spasm sufficiently. In rare cases Finney has resorted to spinal anesthesia.

The thread-bearing catheter is then moved on until the renal pelvis is reached. At this point the stilet is withdrawn a few inches and the cystoscope removed, the catheter being left in place. By pushing toward the kidney with the catheter and pulling away from it with the suture one may make a loop without difficulty. Once the loop has been made, thread and catheter are pulled down until the stone is engaged in the loop. One is now in a position to make as much traction on the stone as one wishes. Finney advises not to use more pull than 1 to 2 pounds. A small scale is attached to the end of the catheter, the patient is put to bed and pain controlled by an opiate. The nurse is instructed to make a pull of 2 pounds, maintaining it for a moment every hour or two for 24 hours. At the end of that time the patient is given a bit of gas and a pull of 5 pounds is made. In 47 of his 50 cases Finney was able to remove the stone in 24 hours. Two required 48 hours and in one failure open operation had to be resorted to and in this case the stone was found embedded in the wall of the ureter.

CAUTION.—It is essential to use a coude or other blunt-tipped catheter so the suture may be attached to its extreme end. If a whistle tip is used the suture can only be attached one-half centimeter from the end of the catheter. This will cause doubling back and may result in injury to the ureteral wall when the catheter is removed.

CASE REPORTS

Case 1.—J. C., HA1/c, admitted 3 March 1945 with gunshot wound of right femure sustained in action 1 month previously. Subsequently this patient de-

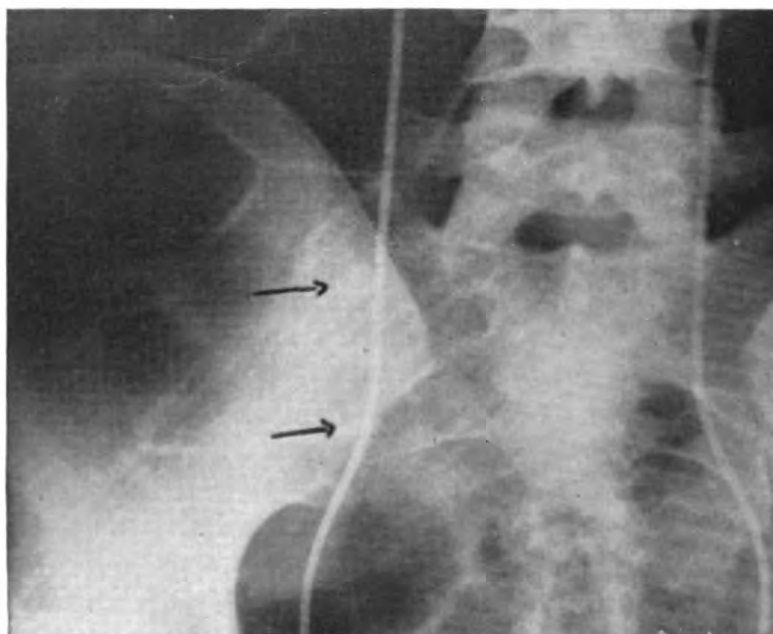


FIGURE 1.—Case 1. Showing two stones in right ureter.

veloped bilateral renal calculi and was transferred to the urologic service. He had numerous attacks of renal colic following which he passed much gravel. On 26 December 1946 he had a severe colic on the right with high fever, and x-ray showed two large stones in the lower third of the right ureter. A catheter was passed beyond the stones and about 30 cc. of thick pus was evacuated from



FIGURE 2.—Case 1. Showing catheter looped around two stones now compressed into one.

the renal pelvis. Because of the severe infection, attempts at removal of the stones were postponed and the catheter left in place. One week later when the patient's general condition had improved a catheter with suture attached was passed and a loop made as shown in figure 2. Following Finney's technique the two stones pressed together into one, were removed on the following day. Subsequent x-ray showed the right side clear of stones and the patient had no further complaints referable to the right urinary tract.



FIGURE 3.—Case 1. Right side is clear of stones. Patient still has calculi on left renal pelvis.

Case 2.—P. M. C., coxswain admitted 16 February 1946 with symptoms of right renal colic. X-ray showed a calculus in the lower right ureter. During 2 weeks' observation patient had several attacks of pain partially relieved by opiates but failed to pass the stone. On 4 March 1946 the patient was cystoscoped and a catheter with suture attached was passed and a loop made engaging the stone. Traction on the catheter was successful in removing a calculus 6 by 3 mm. without undue force.

Case 3.—J. L., A. C. C. M., admitted 19 September 1946 with left renal colic. Patient was cystoscoped but catheter could not be passed beyond a small stone in the lower left ureter. Prodding with the catheter, however, relieved the obstruction and pain, and the catheter was left in place for 24 hours. On 24 September 1946 patient was again cystoscoped and this time a catheter with suture attached was passed to the renal pelvis. A loop was made in the catheter and on traction a small calculus was extracted. This stone was not radio-opaque.

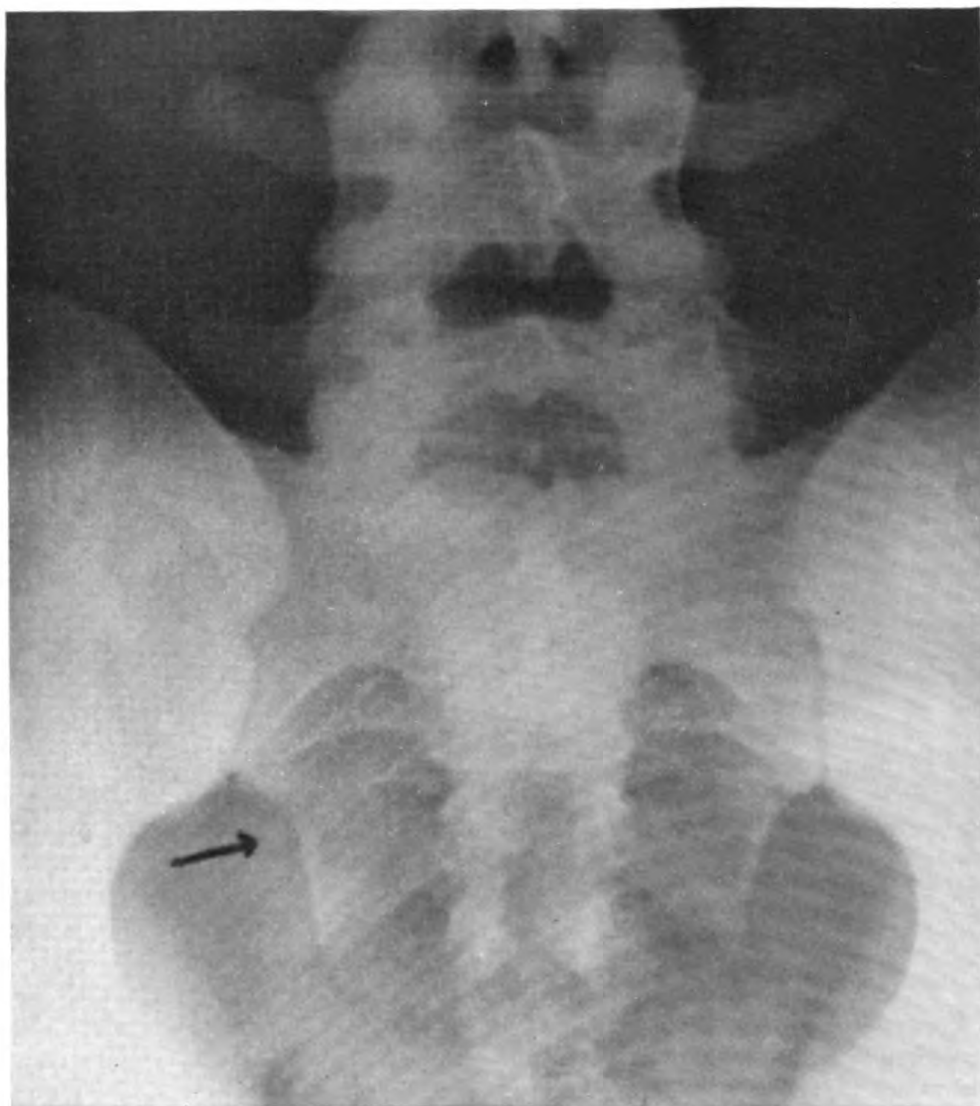


FIGURE 4.—Case 2. Stone on right lower ureter later removed by catheter loop.

RENAL DECAPSULATION IN THE TREATMENT OF OLIGURIA AND ANURIA

EDWARD S. LOWE
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Renal decapsulation in the treatment of kidney diseases is a procedure with considerable historical background. It has been employed extensively—undoubtedly too extensively—in treatment of all sorts of kidney pathology, and has enjoyed varying degrees of popularity, being held in high regard at different times by numerous competent surgeons and urologists, and heartily condemned by other equally good men. It has been almost completely discredited in recent years, undoubtedly because this procedure was employed with high degrees of expectation in conditions which did not and could not respond to it; however decapsulation appears to be gaining a little of its previous acceptable standing as surgeons obtain favorable results with it in treatment of cases of anuria and oliguria. Abeshouse collected three cases of anuria and oliguria following blood transfusion reaction which recovered following decapsulation. Lyons and Raines (5) reported another case which recovered following decapsulation, and found a case in the literature which did not survive despite this operation. The mortality of renal shut-down in transfusion reaction is about 50 percent without operation. We report herewith the survival of a case of chemical nephrosis (oxalic acid poisoning) with anuria which we feel would have ended fatally without operation.

Abeshouse (1) in his review of 2,298 cases of renal disease treated by renal decapsulation collected from the literature since 1902 and report of 10 such cases makes the following statement:

It is the author's opinion that renal decapsulation possesses great merit if utilized in carefully selected cases when it may serve as an important palliative or even life-saving measure.

Numerous theories have been advanced to account for the beneficial effects of decapsulation of the kidneys: interruption or destruction of the sympathetic (vasoconstrictor) nerve connection between the capsule and the cortex resulting in improved blood circulation and secretion; mechanical relief of increased intracapsular pressure; establishment of collateral circulation; increased lymph drainage from the

denuded kidney surface; release of the vessels of the pedicle from the influence (pull?) of the capsule; and nonspecific foreign protein shock. The first two mentioned theories, destruction of the vasoconstriction influence and the release of intrarenal tension, are probably the most acceptable explanations. In the tense swollen kidney, it is likely that relief from intrarenal tension and denervation both play a part. The theory that denervation improves kidney secretion is supported by the fact that section of the splanchnic nerves increases renal secretion as does employment of paravertebral block in conditions of reflex anuria and oliguria.

The indications for decapsulation are progressive oliguria and anuria. The operation should not be undertaken until after appropriate medical treatment has been given a thorough trial, and to be effective it must be done early before irreparable damage has been done. In anuria, the operation should be done within 24 hours of the onset of the shut-down of function. Nice clinical judgment is required in the apparent paradox of thorough medical treatment versus early surgery.

Decapsulation is not a difficult operation, and carries very little risk. Unilateral decapsulation apparently suffices in some cases; however the surgeon may feel that bilateral operation is indicated. Unilateral decapsulation was suggested by Rollwege in an attempt to evaluate the operation in treatment of the nephroses of bichloride and other chemicals in order that the two kidneys might be compared at autopsy. Spinal is probably the anesthesia of choice. The position of the patient upon the operating table depends upon whether unilateral or bilateral decapsulation is contemplated. In unilateral operation, the patient is placed in the lateral position for operation and for bilateral operation, he is placed either prone or laterally with a shift of position of the patient between the two halves of the operation.

The incision for extraperitoneal approach to the kidney is made according to the surgeon's preference, the latissimus and external and internal oblique muscles being retracted or cut exposing Gerota's fascia which in turn is opened to disclose the kidney. The kidney is mobilized and delivered if accessible, or the decapsulation may be done with the kidney lying in situ. The capsule is split from pole to pole along the convex curvature or dorsal surface and the two halves of the capsule peeled to the hylum, care being exercised not to tear the cortex where the capsule may be adherent. The detached capsule may be excised or left in place. The kidney is replaced, and the incision is closed in layers employing a drain or not, according to the desires of the surgeon. Our choice is to employ a Penrose drain in all kidney surgery for 24 to 48 hours or longer as indicated. Operation is facilitated by good positioning of the patient, employment of the kidney elevator to in-

crease the space between the iliac crest and last rib, and by adequate anesthesia to obtain complete relaxation.

CASE REPORT

H. A. E., a 23-year-old Veterans' Administration patient, was admitted to U. S. Naval Hospital, Alca Heights, T. H., as an emergency on 29 July 1946 giving a history of having ingested a "can" of oxalic acid 2 hours previously in a suicidal attempt. He was complaining of abdominal pain and was vomiting thick dark fluid. Blood pressure was 80 millimeters of mercury systolic and 50 diastolic as determined by the mercury manometer. The pulse was 120 beats a minute, thin and thready. There was no evidence of chemical burn to the face, lips, or mouth. In the receiving ward, the patient was given lime water by mouth, gastric lavage with soda bicarbonate solution via a Levine tube, and an intravenous infusion of 1,000 cc. of normal saline to which was added 5 percent dextrose and 10 cc. calcium chloride. His shock increased, the skin becoming cold and clammy, blood pressure 60/40, and the pulse unobtainable at the wrists. At the carotid the pulse was recorded as 108 beats a minute. The patient continued to vomit copious amounts of blood-tinged brown material. He was treated with external warmth, shock position, sedation, plasma and saline intravenously, and bland gastric lavage. After approximately 4 hours he began to react from shock and complained of thirst despite 3,000 cc. of fluid intravenously. During the night he received another 1,000 cc. of intravenous fluid.

The following morning, 18½ hours after the ingestion of the poison, it was noted by the ward medical officer that the patient had passed no urine since admission, and that periorbital edema was evident. Blood urea nitrogen was determined to be 25 mg. percent (normal 12 to 18) and blood calcium was 11.3 mg. percent (normal 9 to 11.5). The urinary bladder was catheterized and 490 cc. of cloudy urine obtained. The specific gravity was 1.018, reaction acid, albumin over 100 mg. percent; and microscopically there were 45-50 red blood cells per high dry field and many white blood cells, many epithelial cells and epithelial casts, and a few calcium oxalate crystals. The red blood count was reported 4.89 million with hemoglobin 15.0 grams. Repeat catheterization after 6 hours resulted in obtaining no urine. The facial edema had progressed to such an extent that the patient was unable to open his eyes. He was becoming more dull mentally. Inasmuch as anuria was present after 6,250 cc. of fluid had been administered by vein in addition to fluid taken by mouth, the edema was progressing to a serious degree, and the blood nitrogen components were elevated, it was decided that surgery was indicated if the patient's life was to be saved.

Approximately 26 hours and 15 minutes after the patient had ingested the oxalic acid, he was taken to surgery and bilateral decapsulation of the kidneys performed under spinal anesthetic. It was noted that there was some congestion of the kidneys grossly, and that the kidney substance bulged somewhat on section of the capsules. The patient withstood the operative procedure well. An intravenous infusion of 1,000 cc. 5 percent dextrose in distilled water was administered during the operation. His blood pressure upon return to the ward was 140/92 mm. of mercury. Blood urea nitrogen determination 5 hours postoperatively was 19.6 mg. percent, and after 9 hours was 15 mg. percent.

On the morning of the first postoperative day, the patient's appearance was not appreciably changed and his blood urea nitrogen was 19.6 mg. percent. The intake of fluid for the first postoperative day was 3,160 cc. However, his kidneys had begun to function and his output was 1,240 cc. The first urine passed was of specific gravity 1.010, was acid in reaction, contained over 100 mg. of

albumin, many red blood cells and much debris. Later in the day, the transparency cleared, the specific gravity became 1.005, albumin was 60 mg. percent, and the number of red and white cells decreased. By 24 hours following operation it was apparent that the facial edema was subsiding and the patient was more alert. At this time a braided silk suture 4 yards long was given the patient to swallow and the proximal end anchored to his face, this to be employed as a guide if his esophagus stenosed and instrumentation was required. During the second 24-hour postoperative period the fluid intake was 3,765 cc. and the output was 2,000 cc. The blood urea nitrogen had returned to within normal limits, being reported as 14.8 mg. percent. Fluids and soft foods were being administered by mouth. Facial edema was practically gone. Urinalysis revealed specific gravity of 1.004, 75 mg. percent albumin, and clearing of the microscopic elements.

Following this the recovery was uneventful. Blood urea nitrogen determinations made in the course of the following 2 months were all reported to be in the normal range. The urine gradually cleared until only a trace of albumin existed. This finding persisted and was present on discharge in October 1946. X-ray examination of the upper gastro-intestinal tract made on 16 August 1946 showed an elastic nonconstricted esophagus, normal gastric mucosal pattern, and a narrowed duodenum and upper jejunum devoid of the normal mucosal pattern. The patient was transferred to the psychiatric service 2 weeks postoperatively and was discharged from the hospital approximately 2½ months after operation.

DISCUSSION

Oxalic acid is a corrosive organic acid which has a local caustic action on the mucous membranes causing dysphagia, pain in the epigastrium, sour taste, thirst, vomiting of a brown fluid (blood, acid hematin), depression, collapse and death. The course may be as short as 3 minutes or may extend over several hours or days. The acid is readily absorbed from the intestinal tract and takes up calcium-forming insoluble calcium oxalate. Ninety to ninety-five percent of the oxalate is excreted by the kidneys. The exact renal pathology in cases of oxalic acid poisoning is not clear other than that the tubules are involved. Gonzales, Vance, and Helpert (3) say: "The kidneys usually contain many oxalates and are engorged with blood. Calcium oxalate crystals may be demonstrated microscopically in the tubules." Thienes (7) states: "The principal pathology is the renal damage, produced by blocking of the tubules by oxalate crystals." Hamilton (4) records: "The kidney tubules become obstructed by the insoluble calcium oxalate, and there is profound renal disturbance." Sollmann (6) notes: "Hemorrhagic nephritis was not observed. The kidneys of a fatal clinical case showed marked renal injury, cloudy swelling, hyaline degeneration and sclerosis of the tubules." This author further states: "These (calcium oxalate crystals) may be excreted in such great amounts as to block the urinary tubules and may thereby possibly lead to nephritis, or retention of urine and uremia." And: "There may be severe tubular necrosis and intra-epithelial crystal deposits."

Treatment of acute oxalic poisoning should be directed to removing the poison from the stomach by induction of vomiting, administration of calcium by mouth in any form to take up oxalic acid making insoluble calcium oxalate, lavaging the stomach, and supplying fluids to facilitate kidney secretion—all in addition to treatment directed to overcome pain, shock, and collapse. If the patient survives the immediate poisoning only to go to progressive oliguria or anuria, steps must be taken immediately to reestablish adequate urinary secretion, or he will surely die. Fluids by vein, heat, or counterirritation to the flanks, and splanchnic block may be attempted. If these fail, decapsulation is indicated; as it has been attended by favorable results in some cases of chemical nephrosis, and is an easier and less hazardous procedure than peritoneal irrigation (2). We suggest that if urine is not secreted promptly following decapsulation, peritoneal irrigation be initiated to carry the patient past the acute renal failure with the hope that kidney function will be resumed.

In the case reported herewith, we feel it was a mistake to supply calcium intravenously, thereby making available more calcium to form an insoluble salt to add to the renal difficulties. That this patient suffered severe renal damage is indicated by anuria, rise of the nitrogenous factors in the blood, formation of severe edema, and the presence of large amounts of blood and albumin in the urine secreted immediately before the kidneys shut down and early after they resumed function.

SUMMARY OF CONCLUSIONS

This case of chemical nephrosis caused by ingestion of oxalic acid did not respond favorably to medical treatment, but developed anuria, alarming edema, and nitrogen retention despite the administration of large amounts of fluids intravenously. Immediately following bilateral decapsulation, the kidneys began to function, secreting 1,240 cc. of urine in the first 24 hours postoperatively, and 2,000 cc. in the second 24 hours. Urinary output was normal thereafter. Blood urea nitrogen began to fall immediately postoperatively, returned to normal and stayed in a normal range thereafter. The urine cleared following operation, the amount of albumin falling to a trace which persisted, and the red and white cell content returned to normal. The edema disappeared. It is concluded that the anuria was relieved by decapsulation of the kidneys in this case, indicating that the operation has merit in selected cases.

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YAWS TREATED WITH SINGLE MASSIVE DOSES OF PENICILLIN

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The purpose of this article is to report the results of a public-health program against yaws using single massive doses of penicillin. The work was begun in October 1946 and this report covers the period until 30 June 1947. The therapy used was a single intramuscular injection of 200,000 units of sodium penicillin in 4 cc. of sterile water. Toward the end of the program, a single intramuscular injection of 300,000 units of calcium penicillin in 1 cc. of beeswax and peanut oil was substituted as it became available. One injection was given to each clinically active case of yaws seen over the 9-month period at intervals varying from 1 to 2 months. The population treated numbered about 5,000 and resided on islands outside the Truk atoll. Figure 1 shows their approximate location and an idea of the distances involved.

The population on these islands is cared for medically by the United States Navy Military Government Dispensary located on Moen Island in the Truk atoll. This is accomplished by the visits of a medical team by small ship about every 6 weeks. The distances as shown on the map preclude more frequent visits due to the lack of ships and personnel which would be required. This, plus the fact that there were no trained personnel on these islands capable of instituting any form of therapy for yaws, led to the trial of the single massive dose therapy with penicillin. The treatment was not considered curative but merely a stop-gap measure to check the spread of yaws until the islands could be staffed with trained personnel capable of instituting curative treatment.

Careful records were kept and they revealed that three ends were accomplished.

1. The total number of cases of clinically active yaws was reduced.

It has been possible since the beginning of July 1947 to institute curative therapy on the islands south and east of Truk as they are now staffed with native health aides trained to give mapharsen and bismuth. Curative therapy with penicillin, which would be much more satisfactory, cannot be instituted because of the lack of refrigerated storage facilities on these islands. The single massive dose therapy

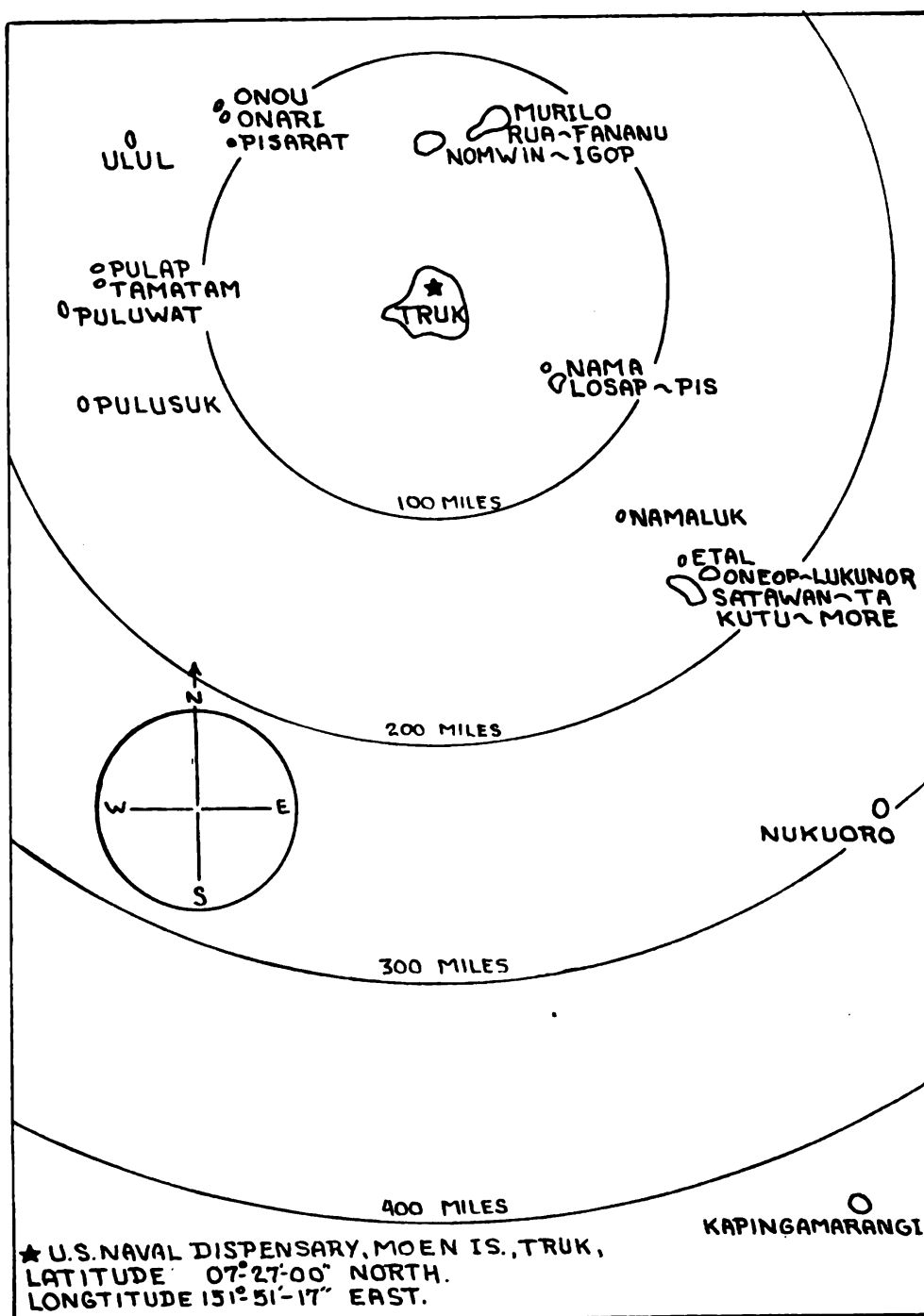
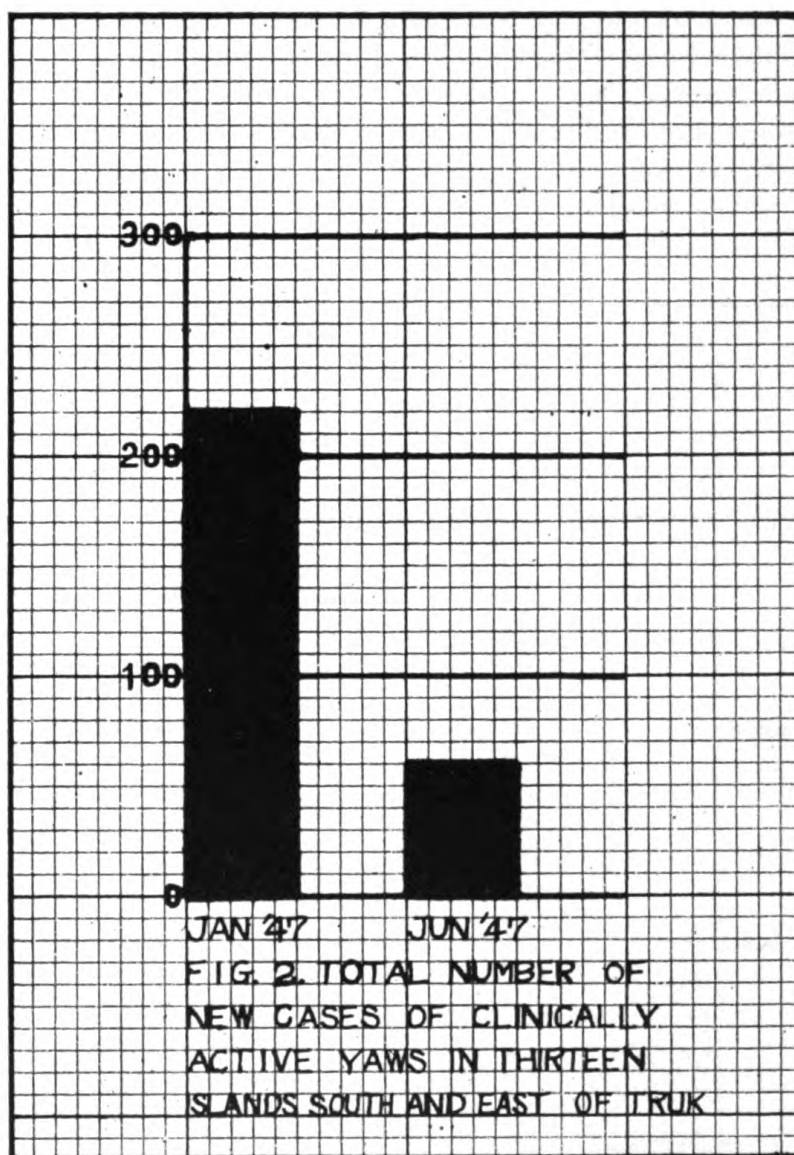


FIGURE 1.



with penicillin will be continued on the islands north and west of Truk until they can be similarly staffed with natives now under training.

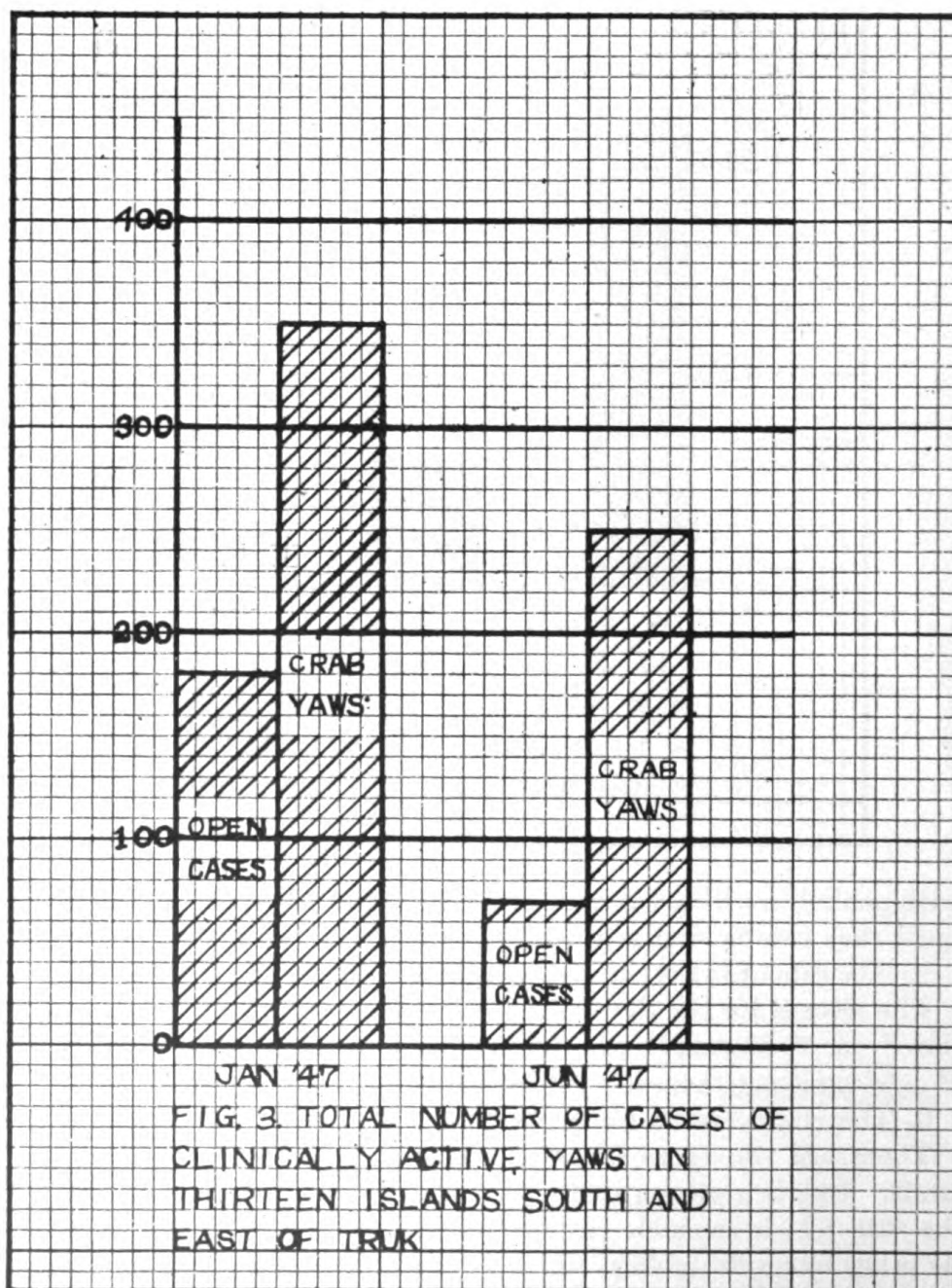
2. The rate of infection with yaws has been markedly reduced.

The records for the 13 islands south and east of Truk show a reduction from 57 new cases per thousand per month in January 1947 to 16 new cases per thousand per month in June 1947 (fig. 2).

3. The character of the yaws lesions has been changed.

There are two types of cutaneous yaws lesions seen on these islands. One is a generalized eruption of small, fungating masses on the skin which resemble raspberries and from which yaws received its other name, frambesia, which is the Latin for raspberry. These

lesions break down and form ulcers if untreated and provide the main source for the spread of yaws, as spirochetes are numerous in the open sores. There is another type of cutaneous lesion which occurs on the sole of the foot and resembles a plantar wart in appearance. It is painful and causes the patient to avoid putting his weight on it, resulting in a crablike gait from which it derives its name of crab yaws. When the program was first started, the pro-



portion of open cases and crab yaws was about 1 to 2. In June 1947 the major portion of the total number of cases still active were of the crab yaws variety (fig. 3).

This is explainable, as crab yaws responds slowly to penicillin even in curative doses. The change in character of the type of lesion seen is considered significant as it is the highly infectious type of yaws that has been reduced and explains the lowered rate of infection.

CONCLUSION

A program of therapy of clinically active yaws with single intramuscular injections of massive doses of penicillin is an effective public-health measure to check the spread of yaws and control the active cases until curative therapy can be instituted.



EXTRAGENITAL PRIMARY SYPHILIS

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Between 18 December 1945 and 18 June 1946, 6 cases of extragenital syphilis were admitted to the United States Naval Hospital, Naval Station, Norfolk, Va. In this period there were 180 admissions for early syphilis. Figures are not included for errors in diagnosis, additional diagnoses or diagnosis undetermined on admission.

Five cases were photographed, and photographs were satisfactory for publication in four. In two cases, histories only are given. Four cases were on the lip, one on the cheek and one on the left index finger. Five patients were white and one was Negro.

The purpose of this paper is to again remind medical and dental officers of the necessity of what Stokes (1) refers to as an "alert suspiciousness of mind" in nonhealing skin lesions, especially on the lip. The subject matter of this article is not new, many previous articles having appeared, but a reminder seems to be indicated. None of the lip cases in this series were admitted for syphilis. In one lip case an investigation for syphilis was carried out and, after two darkfields, the patient was transferred to the hospital with another diagnosis (case 3). In the finger case, the patient was treated with topical applications for 2 or 3 weeks until another medical officer suggested a darkfield examination.

Penicillin was administered to case 3 for "chills and fever" for 24 hours prior to admission. Case 6 was given penicillin on admission and, in spite of this, darkfields were requested. In this connection, I wish to enter a plea for care in the use of penicillin prior to the establishment of a diagnosis. Far too often the syphilologist is confronted by cases where, for some reason or other, penicillin has been administered. Too often the drug is administered for the satellite adenopathy or fever—the primary condition often being overlooked or ignored. From the experiences of Barksdale (2) penicillin renders darkfield lesions negative just as quickly, if not more quickly, than any other drug. It also provokes a serological rise in titer. It is fortunate that this is so in many cases. Sulfa drugs will not affect the darkfield or the serology and, while they may not be so quickly effective against whatever condition it is desired to treat, they at least will not cloud the picture.

About 5 percent of all syphilitic lesions are extragenital and figures compiled by various authors give lip lesions as making up from 63 to 77 percent of all extragenital cases. Other sites are the nipples, anus, cheek, neck, shoulder, and fingers, although a lesion may occur anywhere on the skin. The finger is often the site of the so-called "professional chancre" of physicians, dentists, nurses, and midwives.

In the Negro extragenital chancre is much less common than in the white. Hazen (3), in 33 years at Howard University School of Medicine, recorded 600 patients with chancres and 3,100 with early secondary lesions; each of the latter being investigated for the site of the initial lesion. Only 19 extragenital chancres were found, 12 on the lip, 2 on the tonsils, 1 on the tongue, 1 on the breast, 1 on the finger, and 2 in the groin. Two cases of syphilis d'emblée were encountered. The percentage of extragenital syphilis in this series in Negroes was 0.51. Hazen from his review of the literature gives a probability of at least 5.5 percent as the incidence of extragenital chancres.

Most extragenital chancres can be classified as "sexual" or at least from physical contact. According to Moore (4) not more than 50 examples of nonsexual, accidentally acquired syphilis were found in 35,000 cases at Johns Hopkins, for a percentage of 0.01. These cases resulted from household contact, drinking cups, clothing, linen, barber shops, etc.

The clinical characteristics of extragenital chancre are the same as for a genital chancre: (a) Induration, (b) slow development and healing, and (c) satellite adenopathy. A lesion fulfilling these criteria should make one suspect a chancre. A lesion on the lip fulfilling these criteria is a chancre until proved otherwise. In lip lesions perhaps the most striking feature is the unilateral adenopathy. In the usual age group, as seen in the naval service, a lip lesion with unilateral adenopathy is almost 100 percent syphilis.

A warning must be given about darkfields in lip or mouth lesions. Identifying *Treponema pallidum* in such lesions requires an expert due to the ease of confusion of this organism with mouth organisms. If possible, aspiration of the base of the lesion or aspiration of the satellite gland should be done. The *Treponema microdentium* in the mouth is regular in size and shape and normally is only about half as long and half as thick as *Treponema pallidum*. However, according to Stokes (5) in longer forms it may be almost indistinguishable except by its deep blue staining with Giemsa.

CASE REPORTS

Case 1.—MM3/c, U. S. N. white male, aged 20. Admitted 18 December 1945 with a diagnosis of DU (Mumps). His history was that he felt well until about



FIGURE 1.—Case 2.

2 weeks prior to admission when he developed a cold and a sore throat. He remained on duty. On the day prior to admission he developed a pain in right jaw and swelling below right mandible was noted. The lip lesion was not noted on the history. He was admitted to the contagious ward. The swelling increased and the lip lesion became larger and crusted in spite of local therapy and mumps routine. On 8 January 1946 he was sent to dermatology for consultation. The diagnosis of primary syphilis was given as almost a certainty.

Darkfield was impossible due to crusting and secondary infection but the Kahn was 4 plus, 20 Kahn units. Contact unknown but he had kissed several girls.

Case 2.—S2/c, U. S. N. R., white male, age 21. Admitted 13 February 1946 with a diagnosis of Abscess, Submaxillary #1300. History was that 3 weeks prior to admission he had noted a "fever blister" on left side of lower lip. One week later noted painless swelling under left jaw. The swelling increased and the lip lesion became more indurated and crusted. He was sent to the hospital by his ship for an E. N. T. consultation and a diagnosis of submaxillary abscess was made—the lip lesion being apparently ignored—and admission to the hospital advised. Upon arrival in hospital he was admitted to the surgical service. Ward medical officer on surgery had been on dermatology service and suspected syphilis and asked for consultation. Darkfield was positive and the Kahn was 4 plus, 40 Kahn units. Contact unknown but had kissed "several" girls on a party while on Christmas leave.

Case 3.—S1/c, U. S. N. R., white male, age 19. Admitted 18 June 1946 from the personnel separation center, with a diagnosis of DU (Tumor, right ramus mandible) #2122. History is that he was hit on the jaw while boxing about 6 months prior to admission. Had some swelling under right side of jaw at that time. About 3 weeks prior to admission the swelling reappeared and was painless. However, a "blister" which developed into a sore developed on the lower lip about a week, to the best of his knowledge, after the swelling was noted. Two darkfields were done at the separation center but both were reported negative. One day prior to admission he had chills and fever and penicillin was started. Two days after admission a dermatological consultation was requested. Darkfields were unsatisfactory, probably due to previous administration of penicillin, but the opinion was that it was a chancre without a doubt. Serology: 18 June 1946 doubtful (+), 19 June 1946 doubtful (+), repeat 3 plus, 20 June 1946 4 plus, 20 Kahn units. History of kissing a barmaid in a tavern 2 or 3 weeks prior to development of lip lesion. Other exposure denied.

Case 4.—CBM(PA), U. S. N., white male, age 29. Admitted 13 February 1946 with a diagnosis of syphilis, early #1221. History of "cutting face while shaving" about 3 January 1946.



FIGURE 2.—Case 3.

This cut did not heal and about 1 week later there was associated swelling of the submaxillary glands at the angle of the jaw on the same (left) side. Gave medical officer a history of wife receiving treatment for syphilis so a Kahn was done. This was reported negative on 8 January 1946. No darkfields were done and sulfa ointment and other remedies were applied locally. The lesion refused to heal and another Kahn was done on 4 February 1946 and reported positive. This was repeated on 12 February 1946 and was again reported positive. Kahn on admission was 4 plus, 80 Kahn units. Darkfield unsuccessful due to topical remedies.



FIGURE 3.—Case 4.



FIGURE 4.—Case 5.

Case 5.—SM3/c, U. S. N. R., white male, age 21. Admitted 17 June 1946 with a diagnosis of DU (Syphilis, primary, early) #1221. History of exposure to a "pickup" on 28 April 1946. Used a condom and took a "pro" 2 or 3 hours later. Stated that he had a slight cut on the tip of the left index finger at time of exposure. On 25 May noted a "red spot" on the tip of left index finger. Thought it might be a splinter. About a week later noted an ulcer which continued to get worse in spite of local therapy at the dispensary. On 17 June he was seen by another medical officer who suggested a darkfield. This was found to be positive. On admission there was considerable paronychia involvement. The left epitrochlear was palpable but not markedly enlarged. Kahn on admission was 2 plus, darkfields unsatisfactory. Kahn on 20 June 1946 was 3 plus.

Case 6.—StM1/c, U. S. N., colored male, age 22. Admitted 22 April 1946 with a diagnosis of Lymphadenitis, cervical #1403. History of sore throat and swelling of glands on the left side of neck. A sore on left side of the lower lip had been present for about the same length of time. Soon after this had headaches, fever to 100° F., "drawing pains" in neck and shoulders and weakness of arms. One week prior to admission had soreness in chest and a cough productive of clear mucus. The lip lesion had begun as a "blister" and had progressed to induration and crusting. Upon admission the ward medical officer gave as his impression (a) infectious mononucleosis or (b) chancre of lip. A darkfield was requested on 23 April 1946 but he had been started on penicillin 30,000 units every 3 hours on admission. Darkfield was negative. On 23 April 1946 a significant note is on the clinical record as follows: "Darkfield of lesion on lip reported as negative for *Treponema pallidum*. White blood cells and differential blood count reveals no abnormalities. Patient on penicillin 30,000 units every 3 hours. No improvement. Repeat darkfield, await results of Kahn." On 26 April 1946 the Kahn was reported as 4 plus, 160 Kahn units and he was referred to

dermatology for examination and possible transfer to Dermatology and Syphilology.

History of exposure was that he had picked up a girl about 6 weeks prior to admission (3 weeks prior to lip lesion and glands) and had spent the evening with her. No coitus because she "looked cheap" and he "didn't want to catch anything," but he did kiss her.

SUMMARY

Six cases of extragenital primary syphilis are presented with a discussion of incidence, diagnosis, and clinical features of this type of case. A plea is made for the establishment of a diagnosis before penicillin is administered.

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ARACHNIDISM

With Report of a Case

DALLAS E. BILLMAN

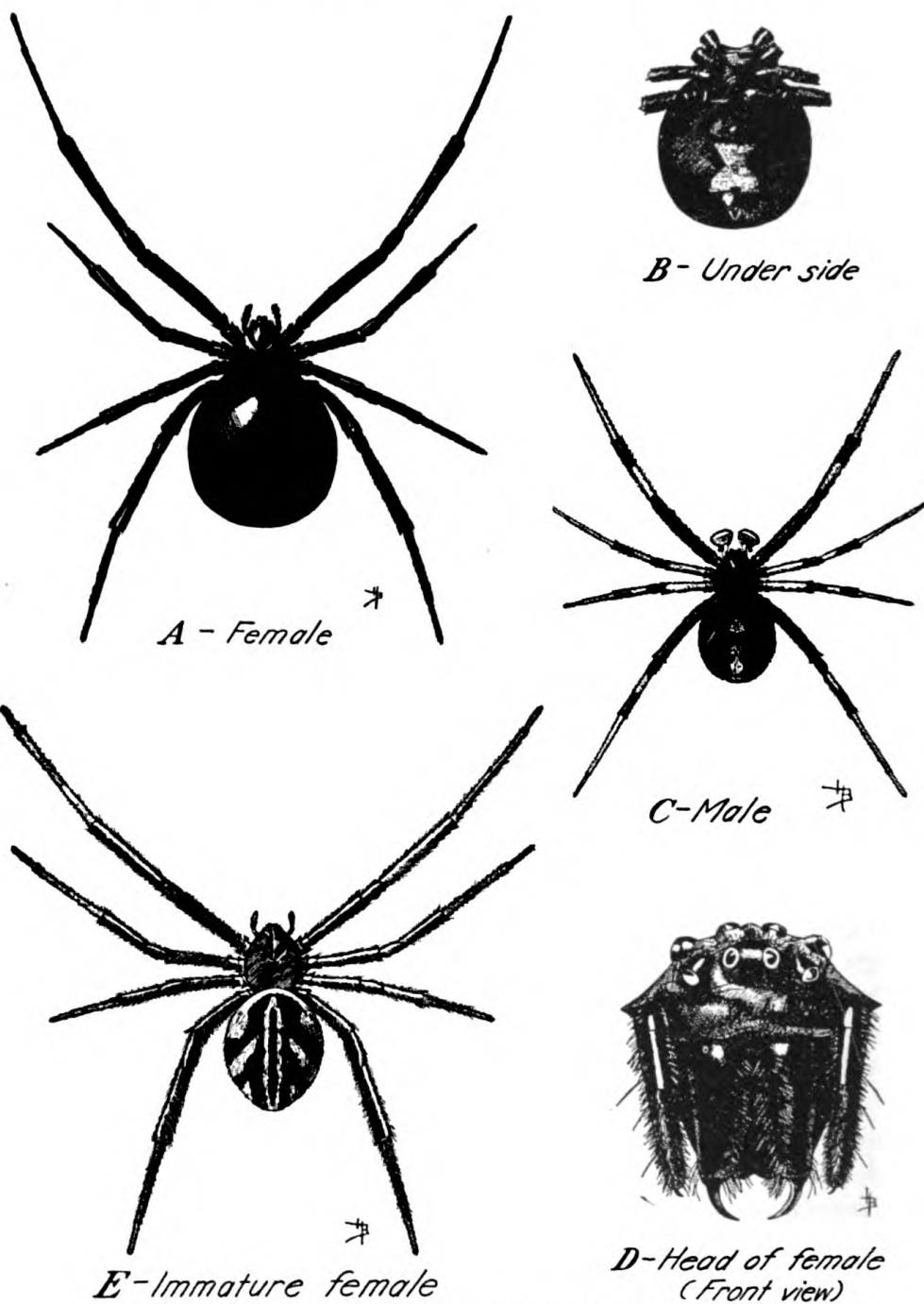
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Although it is definitely recognized today that the syndrome following the bite of a black widow spider is a clinical entity and has a characteristic picture (1), this case is presented to emphasize the similarity to an acute surgical abdomen and to present evidence indicating that the venom may have a direct toxic effect on the myocardium.

Some victims of the black widow are being subjected to needless operations, generally with the provisional diagnosis of acute appendicitis or ruptured viscus. The scientific study of the symptoms before operating for supposed abdominal disease and the inclusions of the spider bite syndrome in the differential diagnosis will prevent many needless operations (2). The abdominal symptoms often overshadow the entire picture and lead to the diagnosis of an "acute surgical abdomen." The excruciating abdominal pain renders the patient willing to submit to any surgical procedure which he believes will relieve his pain hence surgical intervention is often undertaken. In addition the other conditions that have been suspected are pleurisy pneumonia, tetanus, tabetic crisis, food poisoning, and hysteria (3).

The venom of the female *Latrodectus mactans* has been shown to be 15 times as potent as the venom of the rattlesnake (4). The potent nature of the venom can be readily appreciated by observing a victim of the black widow, writhing in agony within 1 hour of being bitten by the spider. The venom is a thick translucent, oily lemon yellow colored fluid, acid in reaction from which a hemolysin and arachnolysin have been isolated. Its nature is neither an alkaloid nor a glucoside but a toxalbumin which has been shown to have injurious effects on the isolated heart of the frog (5). A review of the literature did not reveal any previous definite evidence of myocardial damage in man but bradycardia or tachycardia was a common occurrence. Barkley (6) observed that the pulse in most of his cases was regular but weak and slow, also one of his cases complained of severe precordial pain and palpitation. Frank (3) reported that bradycardia was observed in at least 30 percent of his cases. Walsh and Morgan

THE "BLACK WIDOW" SPIDER



—Drawing by Bureau of Entomology and Plant Quarantine,
U. S. Department of Agriculture.

FIGURE 1.

(7) reported several of their cases with pulse rate of 44, 48, 52, and 55 per minute. Peple (8) in his report of a case simulating diffuse peritonitis in a 6-year-old child mentioned a pulse rate of 120 per

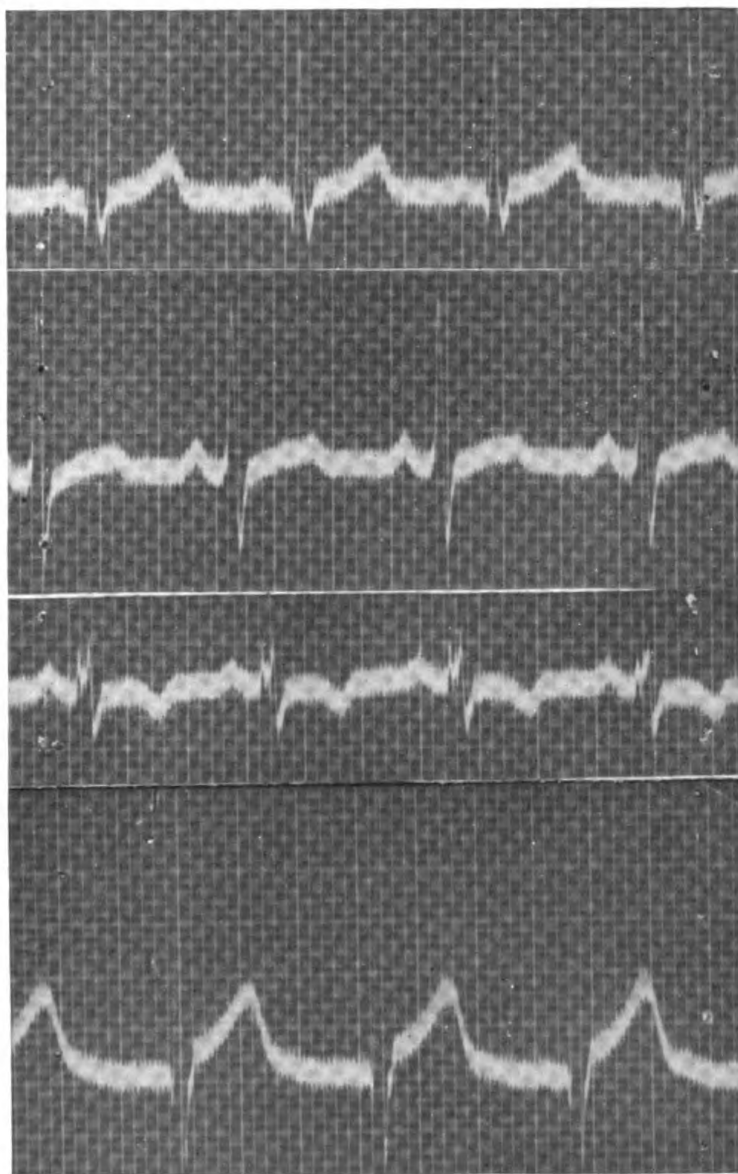


FIGURE 2.—Electrocardiogram made 16 May 1946. Rate, 88; rhythm, regular; P-wave, normal; P-R interval, 0.14 second; QRS interval, 0.10 second; QRS complexes, slurring in lead 3; S-T interval, depressed in lead 3; lead 4, normal; conclusions: (1) borderline tracing; (2) suggest repeat tracings.

minute. Bogen (9) in his discussion of the differential diagnosis of the arachnolysin based on over 400 reported cases mentions that occasionally but not uniformly a slow pulse was noted.

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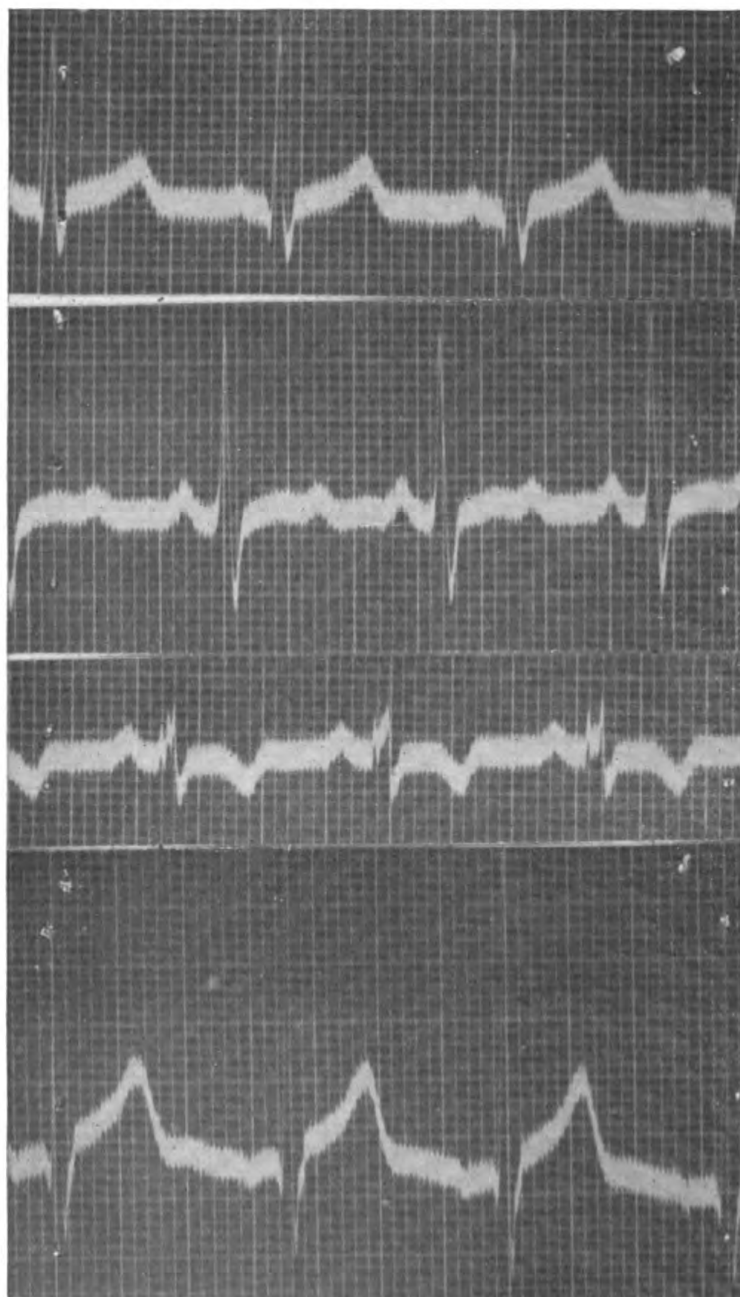


FIGURE 3.—Electrocardiogram made 20 May 1946. Rate, 88; rhythm, regular; P-wave, normal; P-R interval, 0.16 second; QRS interval, 0.10 second; QRS complexes, slurred in lead 3; S-T interval, slightly depressed in lead 3; T-waves, inverted in lead 3; lead 4, normal; conclusions: No change since tracing 16 May 1946.

CASE REPORT

This case which presents evidence of the myocardial effects of arachnidism was a 20-year-old male who was bitten on the medial aspect of the right thigh near the scrotum while sitting in a privy. Within 10 minutes he developed a cramping pain in the right lower quadrant. He became chilly, the abdominal pain became more severe, and he turned in at the admitting ward.

On admission, which was approximately 3 hours after the bite, he complained of agonizing abdominal pain and a severe unbearable stinging, burning sensation of both lower extremities, more marked on the soles of the feet. He ex-



FIGURE 4.—Electrocardiogram made 28 May 1946. Rate, 85; rhythm, regular; P-wave, normal; P-R interval, 0.16 second; QRS interval, 0.08 second; QRS complexes, normal; S-T interval, isoelectric; T-waves, inverted T-3; lead 4, both normal. Conclusions: (1) Since last tracing the S-T 3 has returned to normal and T-3 is not so sharply inverted; (2) normal EKG.

hibited extreme anxiety and restlessness, muscular twitching, tremors, convulsive seizures, nausea, vomiting, respiratory difficulty with expiratory grunt. Examination revealed "boardlike rigidity of the abdomen with some tenderness, simulating an acute surgical abdomen." Reflexes were mildly hyperactive. Pupils were moderately dilated and reacted to light and accommodation. Bouts of perspiration were alternated with chills and convulsions. The temperature on admission was 100.2° F. (rectally), respiration 40 (shallow), pulse 80 (regular). The white blood count 1 hour after admission was 16,450, normal differential. Sedimentation rate was 15 mm. in 60 minutes. The 3 electrocardiograms (figs. 2, 3, and 4) were taken on the second, fourth, and twelfth days following admission. The pulse became rapid after the fourth day reaching a peak of 120; on the seventh day the leukocyte count was 7,700 (normal differential). On discharge (thirteenth hospital day) the pulse rate was 88 per minute.

Therapy consisted of calcium gluconate intravenously 10 percent in conjunction with hot packs, which gave transient relief but had to be repeated frequently. Morphine sulfate, $\frac{1}{4}$ grain, gave no relief. Gold chloride, a neutralizing solution for the venom (Hartinger) (10) had not been used and antivenon (*Latrodectus mactans*), a specific therapy according to Moon and Minear (11) was not available.

Thirty-six hours after the bite a macular rash appeared on the abdomen as well as the upper and lower extremities, which lasted for about 10 hours. Forty-eight hours after the bite the patient felt much improved; the convulsions, muscle spasms, vomiting, chills, and perspiration had completely ceased. The only complaints were a queer feeling of inner nervousness, a slight feeling of pressure in the chest, and some intermittent "burning and stinging" on the soles of the feet. On discharge these subjective symptoms had completely disappeared.

COMMENTS

Since Bogen's (9) review of the literature in 1926, the skepticism as to the existence of the black widow syndrome in man has been replaced by the establishment of a definite accepted clinical entity. The last doubt of the potent nature of the black widow spider venom for man was expelled by Blair (12) in 1933. He allowed a black widow to bite him and the symptoms that developed were identical to the cases previously reported as being suspected victims of the shoe button spider with the red hourglass figure on its ventral surface.

This case gave a history of being bitten while in a privy hence the differential diagnosis of an acute surgical abdomen was considered and rather easily dismissed but many cases will be encountered when no history of a bite can be elicited. Some cases have been reported in which the symptoms began while the patient was in bed or at work indoors, with no history of a bite obtained. Walsh and Morgan (7) reported 29 cases in 1933 of which more than 16 received the bite while indoors, which adds considerably to the difficulty of correct diagnosis.

More of these cases will probably be encountered in the future with greater frequency when the report of D'Amour, Becker, and Van Riper (13) is considered. They reported that the black widow is greatly increasing in number and is invading the large cities. The-

sing (4) reported a young female specimen found on the fifteenth floor of an office building in Cincinnati; others were secured in similar heretofore considered unusual places. The black widow has been reported from all but seven States and very probably may be found in every State of the Union as well as Canada.

The precordial pain associated with the definite bradycardia called our attention to the question of the myocardial effects of the venom. The slow pulse is exactly opposite to what one would expect to find in the writhing, pain-wracked, almost hysterical victim of the spider. Blair (12) in his experimental bite on man indicated three well-defined stages of the clinical picture: The first stage, or lymphatic absorption; the second, or vascular dissemination which is the most critical period characterized by a profound state of shock; and the third, or elimination which presents evidence of an acute (toxic) nephritis. He developed a pain over the precordium 38 minutes following the bite and presented a pulse rate of 75, much weaker than normal; 25 minutes later the pulse was very weak and its rate was 62, within 1 hour the pulse rate was very rapid, unaccountable, weak, and thready.

It is felt that the bradycardia plus the suggested myocardial effect as exhibited in the electrocardiograms (figs. 2, 3, and 4) constitute sufficient evidence to warrant more emphasis placed on the cardiac state in future cases of arachnidism that come under observation.

SUMMARY

1. The importance of considering arachnidism in the differential diagnosis of an "acute surgical abdomen" has been emphasized.
2. A case was presented and literature reviewed which exhibit evidence of the myocardial effect of the venom.
3. It is suggested that future cases be thoroughly investigated from the cardiac aspect and reported.

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A REVIEW OF NEUROSYPHILIS

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With the end of hostilities in August 1945 and the subsequent influx of men through the separation centers, the long-predicted residuum of the tremendous increase of syphilis became readily apparent. This article is a review of 62 cases of neurosyphilis treated at a naval hospital interpreted in the light of known luetic facts, and investigated along the newer trends in neurosyphilitic treatment.

The patients ranged in age from 19 to 54. Sixty-nine percent were 35 years old or younger, 10 percent were 45 years old or older, while the average age was 31.9. All but two patients were males. Forty-seven percent of the patients were referred here from the separation centers of this area where often their syphilitic infection was detected for the first time. Eighty-nine percent of the patients had had some form of antiluetic treatment prior to coming to this hospital. Seventy-three percent of the treated patients had been given penicillin either alone or in combination with the arsenicals and heavy metals. Usually this penicillin was given just before being referred to the hospital. Only one patient had been given fever previously.

A review of the histories of cases emphasized once more some of the long-observed characteristics of neurosyphilis. Some believe that there is a specific neurotropic strain of *Treponema pallidum* which is responsible for syphilis of the central nervous system as evidenced by the scarcity of primary and secondary manifestations in this type of syphilis. The series presented by the authors agreed with this observation as only 37 percent of the patients had had a primary penile lesion or secondary rash. Another interesting observation was the profound spinal fluid changes that often took place in an obviously recent infection. Many of these cases reported directly to a separation center from overseas where they had had recent exposures. Most of these patients were entirely asymptomatic and were only discovered by routine serology. It emphasizes once more the need for early spinal fluid examination in cases of primary syphilis,

¹ Resigned June 1947.

since it is well-known that a significant percentage will show abnormal spinal fluid changes early in the course of the luetic infection.

CLASSIFICATION

TABLE 1.—*Classification of cases*

Asymptomatic neurosyphilis.....	37
Mild.....	24
Severe.....	13
Meningovascular neurosyphilis.....	14
Dementia paralytica.....	4
Tabes dorsalis.....	6
Tabo-paresis.....	1
Total cases.....	62

The classification of neurosyphilis has long been a problem. Marsh (1) (2) in 1941 went into the pathogenesis of neurosyphilis based on his experiences with autopsy findings as correlated with the clinical picture. He came to the very logical and simple conclusion, as others before him had, that all neurosyphilis starts as a leptomeningitis, remains as such, or spreads to the blood vessels and/or the parenchyma. Nevertheless, most men find it more convenient to classify neurosyphilis on a combined clinical-pathological basis. The authors have done likewise. The criteria were briefly as follows: (a) Asymptomatic neurosyphilis (Neurosyphilis, Serological)—characterized by no symptoms or signs, but an abnormal spinal fluid of the syphilitic pattern. This is the so-called "paper neurosyphilis." In most cases it represents early neurosyphilis. We have divided these patients into two groups on the basis of the spinal fluid. The first group showed mild or moderate spinal fluid changes of the grade I or II type (according to the prognostic typing of spinal fluids, as originally suggested by Moore and Hopkins in 1933). The second group showed marked spinal fluid abnormalities of the grade III pattern. This is what Stokes, Beerman, and Ingraham (3) call the "Red Flag" formula, and what Solomon has labeled "Paresis sine Paresi" or asymptomatic latent preparetic neurosyphilis. In many cases it probably is the prodrome to dementia paralytica and undoubtedly should be treated as such. (b) Meningovascular neurosyphilis (cerebrospinal neurosyphilis)—characterized by an abnormal spinal fluid and clinical evidence of neurosyphilis but no syndrome recognizable as dementia paralytica or tabes dorsalis. The spinal fluid is usually of the grade II type although it may be I or III. It is chiefly a meningeal irritation as evidenced by the high cell count. (c) Dementia paralytica—characterized by the typical clinical picture. The spinal fluid is almost always abnormal and usually of the grade III type. (d) Tabes dorsalis—characterized by the typical tabetic syndrome. There is usually a grade II spinal fluid although it may be normal.

SYMPTOMS AND SIGNS

Remarkably few of the cases presented symptoms that could even remotely be attributed to neurosyphilis. Of the 62 cases, only 24 per cent were symptomatic. Thirty-nine per cent of the patients had positive physical signs pointing to neurosyphilis. Of these, by far the most common were the ocular signs. The most frequently encountered ocular signs were the various pupillary abnormalities ranging from the typical Argyll-Robertson pupil to an inequality and sluggish reaction of the pupils to light. There were eight patients with Argyll-Robertson pupils and one case of optic atrophy. Incidentally, there has long been an argument as to whether the Argyll-Robertson pupil is completely specific for neurosyphilis. Throckmorton (4) feels that it is absolutely pathognomonic of syphilis and never occurs in anything other than syphilitic invasion of the central nervous system. One of our cases illustrated that this can often be more than an academic point. This particular patient was referred here with diplopia as his only complaint. The history revealed that he had had a primary, darkfield-positive penile chancre in 1933. He received 2 years of intensive and faithful chemotherapy and the originally positive blood Wassermann became negative and has stayed so to the present. Two months prior to hospitalization he developed a persistent diplopia. The only positive physical finding was an Argyll-Robertson pupil. The spinal fluid was normal except for a low mid-zone colloidal gold curve. It was felt here that this was a case of neurosyphilis.

TREATMENT

With the exception of three patients treated in 1944, all the cases were treated from September 1945 through July 1946. The treatment has naturally varied to suit the individual needs of the patient but on the whole the same fundamental plan has been followed. All 62 patients received some artificial fever, all but 6 were given penicillin, and all the patients were given arsenical and bismuth injections.

For our artificial fever we used the hot, humid-air cabinet similar to the original Kettering Hypertherm. The technic was approximately the same as employed by Krusen (5) at the Mayo Clinic. The usual plan was to give a total of 50 hours of fever at an average rectal temperature of 105° F. in ten 5-hour sessions every other day. Continuous intranasal oxygen was given and one-third grain of pantopon was given routinely when the temperature reached 102° rectally. We experienced the usual run of minor fever complications such as nausea and vomiting, nervousness, hysteria, and hyperventilation. Our major complications were: two cases of moderately severe leg burns, two cases of hyperpyrexia with the temperature shooting uncontrollably to 107°–108°, four cases of shock, and one case of Adams-

Stokes syncope. Eighty-nine percent of the patients completed the full 50 hours of fever. The remaining 11 percent received varying amounts of the prescribed course and were stopped for the various reasons cited above. There were no fatalities or apparent permanent physical damage as the result of fever, which is of some significance in view of the fact that 12 patients were considered poor risks on account of myocardial damage, hypertensive renal disease, or advanced age and debilitation.

As a rule penicillin was started the day before fever and continued throughout the fever course for an average total dose of 6.7 million units. At first the individual dose was 40,000 units but it was subsequently stepped up to 100,000 units every 3 hours.

Mapharsen was usually started a few days before the onset of the fever course and then was continued at the start of each fever session. Bismuth was given the day before each session. In many cases the patients were started on tryparsamide following the fever course and urged to complete the treatment after discharge from the hospital. In most cases the patient was given another spinal and discharged to further naval duty or civilian life shortly after the completion of the fever and penicillin therapy.

RESULTS OF TREATMENT

The evaluation of results in neurosyphilis is at best a difficult and long-range procedure. It is only with large numbers of patients treated and worked up in a constant manner and followed for years that definite conclusions regarding the efficacy of any particular therapeutic technic can be reached. The authors, of course, were not in a position to meet these postulates, nor as yet are any of the current investigators of penicillin. Consequently, no more can be done than to point out what trends are evident from the available facts.

The literature has recently been full of the results with penicillin. Stokes and Steiger (6) and their associates have very recently reported on a series of 283 cases of neurosyphilis treated with penicillin alone and followed for an average of 1 year. They came to various conclusions, among which were: (a) Penicillin is not quite as good for some types of neurosyphilitic spinal fluids as other methods, but on the whole is superior to fever. (b) In asymptomatic neurosyphilis, penicillin stands supreme. (c) Penicillin, like fever, seems to have a cumulative effect, increasing its therapeutic benefit, at least on the spinal fluid, up to a peak at 4 months. (d) The most striking effect of penicillin was on the improvement of the spinal fluid formula. Thirty-six percent of the fluids were rendered normal or near normal, while 74 percent of all fluids were definitely improved. (e) Fever still outranks penicillin in the field of clinical improvement. However 65 percent of their symptomatic cases showed some clinical improvement.

O'Leary, Brunsting, and Ockuly (7) in a recent article, also on the subject of penicillin in neurosyphilis, make observations on the overall reported results with penicillin colored with their own work on a series of 100 cases. They are very wary of expressing a dogmatic statement pro or con, feeling that more time is necessary before any definitive opinion is possible. They do indicate the following trends: (a) They agree with Stokes that meningeal neurosyphilis responds very nicely both clinically and serologically to penicillin. (b) They gave 56 patients penicillin plus fever (malaria). It was felt that the results in this group were no better than fever alone. (c) Clinically, the chief benefits that were noted from penicillin were gain in weight and reduction of the shooting leg pains in tabes dorsalis. They failed to note the crisp type of clinical improvement in dementia paralytica that was received with fever. It was felt that penicillin was of no benefit in dementia paralytica while fever has long been used with definite and often startling relief.

In between these somewhat divergent points of view, various other authorities aline themselves with the argument existing between penicillin and for the most part fever. The general consensus seems to be that: (a) Penicillin very definitely improves the spinal fluid of all types of neurosyphilis. But so does fever, and for that matter, the arsenicals. (b) The evaluation of the clinical course in patients treated with penicillin will need a longer follow-up period, but the results so far in dementia paralytica have been discouraging. (c) Fever is still the treatment of choice in dementia paralytica.

TABLE 2.—*Results of treatment—How the various components of the spinal fluid responded to treatment—results in percent*

Component	Improved	Unchanged	Worse
Cells.....	90	5	5
Total protein.....	71	4	25
Serology.....	58	24	18
Colloidal gold.....	74	16	10

NOTE.—The above table has been corrected, i. e. elements which were normal to begin and normal after treatment, have been excluded from the computations.

In formulating their conclusions on neurosyphilitic treatment, all investigators use the spinal fluid as an important criterion. Dattner, Thomas, and Wexler (8) use the spinal fluid almost exclusively in evaluating, treating, and prognosticating their cases. They feel that the spinal fluid is the only reliable guide to the course of the disease and that there is a very close correlation between the spinal fluid changes and the eventual clinical outlook. Many other men place more emphasis on the clinical response since they feel that there is often no relationship between spinal fluid reversal and clinical im-

provement. All will agree that neurosyphilitic symptoms are difficult to assay since they are so diverse and protean. It makes a clinical estimate correspondingly difficult. On the other hand, all will agree that spinal fluid comparisons are entirely objective, for the most part accurate, and at worst an important criterion in the evaluation of the progress of the disease. Since the majority of the cases treated by the authors were symptom-free, results were based largely on the spinal fluid response. All but two of the spinal fluids were abnormal prior to treatment.

TABLE 3.—*Results of treatment—response of the spinal fluid to treatment—results in percentages*

Type of case	Number of cases	To normal	Marked improvement	Definite improvement	Slight improvement	Total improvement
Asymptomatic.....	32	16	47	25	3	91
Mild.....	21	24	37	24	5	90
Severe.....	11	0	64	27	0	91
Meningovascular.....	11	9	55	18	9	91
Dementia paralytica.....	4	0	0	50	50	100
Tabes dorsalis.....	3	0	0	67	0	67
Taboparesis.....	1	0	0	0	0	0
Total.....	151	12	41	28	8	89

¹ 2 cases were not included because of initial normal spinal fluids. 9 cases were not included because of incomplete laboratory data. The various categories listed above are somewhat arbitrary and are based on a general appraisal of the spinal fluid response. A normal spinal fluid was defined as: Cells, 5 or less; total protein, 40 mg. percent or less; serology, negative; colloidal gold, 0000110000 or better. If there was any doubt as to whether the spinal fluid looked better after treatment than before, it was listed as unchanged.

Results are given in the accompanying tables. Spinal fluid examinations were done on the average of 13.5 days following the completion of the 50 hours of fever and the course of penicillin. The most sensitive component of the spinal fluid was the cell count. Ninety percent of all fluids showed a decrease in the number of lymphocytes. The total protein and the Kahn or Kolmer were the most prone to become positive or more positive with treatment. Undoubtedly, some of these were provocative reactions. A surprisingly high percent of favorable colloidal gold responses were obtained. A relatively high percentage of serologies were unchanged by the treatment which is in agreement with the long-observed fact that the spinal fluid Kahn or Kolmer is the most resistant component to treatment and often stays positive for months following the completion of treatment. The authors, like all others, noted the rather striking reversal of the spinal-fluid formula. Eighty-nine percent of all cases showed some degree of spinal-fluid improvement. Only 2 percent of the fluids were made worse by the treatment. Fifty-three percent of the fluids were rendered normal or showed marked improvement.

Very few conclusions can be drawn concerning the response of the various categories of neurosyphilis since sufficient cases of the more advanced types were not treated. It was noted, however, that most

of the normal and markedly improved fluids were associated with the milder forms of neurosyphilis. Results were roughly comparable with those of Dattner, Thomas, and Wexler (8) and perhaps better than those reported by Stokes and Steiger (6) and Gammon and others (9). This may bear out the contention made by O'Leary and others (7) that fever alone is as efficacious as fever plus penicillin. Two factors undoubtedly played a large part in the composition of the results obtained by the authors. The first was the large predominance in the series of asymptomatic neurosyphilis cases, which classically respond well to treatment. The second factor was the short elapsed time between completion of treatment and the spinal-fluid examination. Since it is well known that the spinal fluid continues to improve long after fever is completed, it is reasonable to suppose that these results would have been better if more time could have been allowed before examining the spinal fluid. Thus, these two factors tend to, at least partially, cancel each other. Incidentally, as has been mentioned, a high percentage of the patients had been given penicillin just prior to coming to this hospital. This was regarded as additional penicillin to what was given here and it was not felt that it materially affected the results since it has been shown that there is surprisingly little difference in therapeutic effect between high and low dosage of penicillin (6).

TABLE 4.—*Comparison of various types of treatment—response of spinal fluid—all types of neurosyphilis included—results in percent*

Type of treatment	Investigator	Number of cases	To normal	Improved	Unimproved
Fever (malaria).....	Dattner and Thomas (7).....	298	26	86	14
Arsenicals.....					
Penicillin alone.....	Gammon and others (8).....	89	12	72	28
Fever (artificial).....					
Penicillin.....	Authors' series.....	51	12	89	11
Arsenicals.....					

¹ Dattner and Thomas regard a fluid with 4 cells or less and 30 mg. percent of protein or less as an inactive fluid and therefore a favorable result regardless of the serology or colloidal gold. This is the D.-T. (Dattner-Thomas) inactive formula.

² 7 percent of the fluids were normal to start and normal to end and were therefore not added to the unimproved category.

NOTE.—The above table is admittedly somewhat artificial and perhaps misleading but it is felt that it at least gives a rough comparison of the various regimes.

No attempt was made by the authors to closely evaluate the clinical results for two reasons: (a) The scarcity of symptomatic cases, and (b) the short and inadequate follow-up period. However, sharp and often dramatic improvement was noted in many patients.

In closing, it would seem that the advent of penicillin in the treatment of syphilis in general and neurosyphilis in particular has stirred up a thorough reinvestigation of the situation that is bound to produce a more complete understanding of the disease and its treatment.

CONCLUSIONS

1. Sixty-two cases of all types of neurosyphilis treated at this hospital with fever, penicillin, and arsenicals are reviewed.
2. Sixty percent of the cases were classified as asymptomatic neurosyphilis.
3. All but two cases had an abnormal spinal fluid prior to treatment.
4. Twelve percent of all the fluids were rendered normal by treatment: 89 percent of the spinal fluids showed improvement of some kind. The cell count was the most responsive element to treatment.
5. Many patients showed definite clinical improvement.
6. It is felt that fever and penicillin together are probably better than penicillin alone but may be no better than fever alone.

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MANAGEMENT OF WOUNDS AND WOUND HEALING

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Wound healing, as might be expected, is dependent on a large number of factors locally in the wound and systematically in the patient, factors influenced by the surgeon and decisions he may make in regard to the wound. Analyses of thousands of cases have been made at various institutions and certain ideas derived from these were further studied in the experimented laboratories under controlled conditions. While there exists much controversy in regard to healing of wounds, there are many influencing factors which have been studied, the effects agreed upon, and acceptable treatment recommended. Some of this work will be discussed in the following pages.

. In many instances the local condition of the wound is the most important factor relative to its healing. Some of the characteristics of wounds which influence healing are size and shape of the wound, its location on the body, the tissue structure involved, and the amount of infection introduced. The amount of devitalized tissue, foreign bodies present, and the time and type of treatment of the wound are known to be important.

In regard to the size and shape of wounds there has been some difference of opinion as to the rate and direction of wound healing, but it is sufficient to say that wounds under ideal conditions heal at a rather constant rate, and the basal cell proliferation progresses in all directions over the granulating surface until contact is made with proliferating cells from other directions. This is seen in the case of pinch grafts where the epithelium pushes out in all directions from these islands of tissue. Whether this spread is controlled by a chemical repulsion or a nonaffinity of these cells for like cells or just that the mitotic division of these cells is more effective where they have a space to grow is not entirely known. In the case of the intact skin the cells are pushed upward and when the continuity of the skin is broken a new direction of spread is open to them. Experimentally it has been shown by Apperly and Cary that in small wounds the daily rate of growth remains the same in spite of the decreasing diameter of the wound; however, in practice we see that

in extensive wounds the speed of this healing process is frequently decreased toward the center of the wound probably because of interference with blood supply by scar tissue incident to the healing process. This is particularly noticeable in the lower extremities when the wound is over the bone.

The location of the wound is of importance, probably in a large measure related to the blood supply and drainage of the wound. The hands and face heal rapidly while wounds of the back and lower extremities are more prone to require prolonged healing time.

Surgical wounds of entrance into the abdominal cavity may be classified for the sake of simplicity into vertical and transverse incisions, the transverse incisions including the oblique incisions as *McBurney* and *Kocher*. It has been shown by most collected statistics that disruption is, by far, more common in the vertical wounds. This however is only part of the picture. These cases under study were those in which the majority of extensive operative procedures were performed through vertical incisions, and the less extensive operations on patients in good general condition were performed through one of the transverse incisions. *Hartzell* and coworkers (10) reported three cases of wound disruption in cases of transverse incisions, but no eviscerations.

The present trend appears to be moving slowly toward a more extensive use of the transverse incision. It is believed that the incident of wound disruption will decrease because of less interference with the vascular supply and with the innervation of the tissues involved.

The amount of devitalized tissue present is important, as mentioned by *Bowers* (6), *Pickrell* and *Clay* (20), *Bruger* (7), and others. The process of healing being such that devitalized material must be attacked and destroyed before fibroplasia is actively initiated.

The treatment of the wound is probably the most important factor and includes many of the subjects mentioned and to be mentioned. In traumatic wounds which involve only the skin and subcutaneous tissue, received under conditions where we can feel that they have not been too heavily contaminated, and we see them within a 6- to 8-hour period, we can clean the surrounding tissues and the wound with soap and water. Following this the wound may be surgically prepared, debrided, and a primary closure accomplished. When the above requirements are not met by the wound, it should be cleaned thoroughly, then debrided and packed gently with vaseline gauze. The treatment of these wounds of soft tissue resulting from trauma of war and treated primarily as above, has undergone much change during this war. Some of the changes still have not had sufficient publishing of the clinical evidence to gain wide acceptance. During and after the

First Great War the accepted treatment of these wounds was based primarily on allowing them to remain open. Then various types of chemical washes and irrigations were contrived to eliminate the infection. To be successful, this treatment was rather complicated, requiring frequent compounding of solutions such as Dakin's and constant care in flooding the wound with these solutions. No one who has received cases adequately treated by this method can doubt its efficacy. However, in treating a large number of cases at once, the method is difficult. The method of placing these patients in casts and leaving them undisturbed was advocated and was shown to be of value by Trueta in the Spanish Civil War. By this method we eliminate, at least, contamination of the wound by dressing frequently. In the early months of this last war it was believed that the only safe method of treating battle wounds was by leaving them open and allowing them to heal spontaneously by granulations and epithelialization, a long period of morbidity being required. In many areas of operation surgeons decided to attempt secondary closures in those cases which to them appeared relatively healthy. The results were good and the morbidity cut to a fraction of that of previous treatments. The time when closure could be most safely accomplished became a matter of study. The early estimates of from third to fourth week gradually was brought down to from 6 to 12 days. This period has gained the greatest acceptance, however, closure on the second to fifth days has given just as good results with no greater complications.

What is the basis of treatment by secondary closure? First, we know that much of the so-called "infection" in granulating wounds is merely the growth of saprophitic organisms in the exudate from the granulation tissue, and it is a surface contamination. Second, if gas-bacillus infection or virulent streptococcus infection were to develop in the wound, it probably would be evident in the first 48 hours. Third, there is no better dressing for any wound than skin.

At the present time the plan of treatment of open wounds should be inaugurated after 48 hours if the patient is in a hospital where adequate facilities are available. The wound can be prepared by any local antiseptic or antibiotic agent for 24 hours, but wet dressings of saline are probably just as effective. If the wound has not been completely debrided this should be done first, until only normal tissue remains. The skin and subcutaneous tissue is undermined as indicated. Closure usually requires some tension on skin edges, but this should not be excessive. Any remaining open area between skin edges should be covered with split thickness skin graft.

Sutures have been used for at least 3,500 years and the desire to know whether absorbable or nonabsorbable sutures should be used has been present in the minds of physicians since at least the early eighteenth

century. There have been numerous scientific studies to determine the effect of the various kinds of suture material on wound healing, but the opinions on this are not universally accepted.

Catgut which was previously chemically sterilized is now entirely heat sterilized because of recent standards outlined in the U. S. Pharmacopeia XI and required under the Food and Drug Act. The absorption time of catgut has been found to be undependable because of various factors, as a defect in the gut which may be due to handling or tying, the variable rate of absorption as shown by numerous workers in cases of suppuration and the ability of certain types of tissues to absorb catgut rapidly as shown by Bowen (5). Kraissl (16), Kraissl, Kesten, and Cimiotti (17) and Langston (18) in their papers reported sensitivity to catgut. However, later well-controlled studies seem to show that sensitization of a patient to catgut does not exist (20). Reil (21) believes that since the protein in catgut exists in the insoluble form and when break-down does occur, it leaves no albuminoid residue which could act as an antigenic agent.

At the present time most authors and investigators look at the problem in the light that if the allergy to catgut does exist, it is of scientific rather than clinical interest and probably has no influence on wound healing or disruption. Clinically the important thing is to use the smallest possible suture to accomplish and maintain closure. It is well also to remember that heavy chromic catgut is absorbed more rapidly than the lighter variety. The care in ligating vessels, including small quantities of tissue in the ligature, is one of the most important things to remember. Strangulated tissue is nonviable tissue and as such must be absorbed before the healing can commence.

A word about retention sutures.—On the whole retention sutures placed too tight will strangulate large sections of tissue, cut the fascial layer and skin and endanger continuous sutures of the fascia if used. The retention suture, if used properly, is loose at the time of operation, become snug on about the third postoperative day and by the sixth to the tenth day when disruption usually occurs they are loose again. However, they may prevent evisceration in the case of a wound disruption. Retention sutures accomplish no more than a snug binder, if properly applied and maintained.

Nonabsorbable suture material, particularly cotton and the accepted wire sutures, are believed by all who have studied them to cause less reaction in the surrounding tissue (11) (3) (14).

Local medications in wounds have been studied clinically and experimentally by scores of authors and millions of words have been written about them. Prophylactically it was found that the sulfa drugs locally did little to prevent infection in wounds and seemed to delay healing. (Foreign material in a wound must be absorbed

before healing begins.) Penicillin powder was not used locally in the wound as a prophylactic measure by medical officers of this country during the war, but the British used penicillin powder dusted in wounds after the initial surgical treatment. Their clinical results seem to justify its use. The local use of the drug was supplemented by a 5 to 10 days of the drug given systemically however (13) (19).

In the treatment of infected wounds or granulating wounds covered with a heavy exudate, various types of local antiseptics have been used with varying and even contradictory success. We have used a group of drugs including hypertonic saline, chlorophyl, azochloramid, streptomycin, penicillin, and activated zinc peroxide on a series of amputation stumps and found that while each had some effect on the bacterial flora present, they had no great effect on changing the rate of healing. Recently we have used a substance called Furacin (5-nitro-2 furaldehyde semi-carbazone) in water-soluble base which seems to eliminate the massive exudate present in some wounds and allows healing to progress more rapidly. The writer has not used this over a sufficient period to make a definite statement recommending its effectiveness as yet.

In regard to the systemic factors influencing wound healing the nutrition of patients has always been accepted as important, but just what is it about malnutrition or just "undernutrition" that prevents healing of wounds? The lack of material to metabolize as burnable fats and sugars, the lack of protein factors for the repair processes themselves are all-important to some extent. The lack of protein and vitamin C have been shown experimentally to have a detrimental influence on wound healing and will be discussed at greater length.

Generalized disease of the vascular bed or diseases effecting the blood itself have an influence on healing of wounds by neglecting to supply the local nutritional requirements of the wound and interferes with the removal of wastes from this area.

The role of proteins in relation to wound healing has interested many investigators. Clark (8) showed in 1919 by experimental studies, using dogs, that when a diet high in protein was used there was no quiescent period in the repair of the wounds and that contraction began at once. Arey (1) in 1936 showed that a high protein diet aided healing by accelerating fibroplastic proliferation and that cellular activity on the whole increased. He also stated that the quantity of secretions from the wound decreased. Thompson, Ravdin, and Rhoads (23) showed in 1936 that catgut loses tensile strength more rapidly in tissues in the presence of hypoproteinemia and that this hypoproteinemia could be relieved by injection of plasma and normal healing would occur. Hartzell, Winfield, and Irvin (10) in a series of 20 cases of wound disruption found that all had hypoproteinemia

to some degree. Rhoads, Fleigelman, and Panzer (22) substituted acacia in the place of plasma in the study of three hypoproteinized dogs and found that fibroplasia occurred as well as in those treated with plasma. This would suggest, as mentioned by the authors, that the formation of fibroblasts is not dependent on the concentration of serum proteins themselves but may depend on the osmotic effect of these proteins. Koster and Kasman (15) in the study of 40 cases of wound disruption found that only 15 cases or 38 percent had what they considered hypoproteinemia (6.5 grams per 100 cc. or below). In the study of 1,358 cases of routine surgical admissions in which serum proteins were determined there were 4 cases of wound disruption or an incident of 0.29 percent, but in these 4 cases serum proteins ranged from 6.3 to 7.3 grams per 100 cc. which they considered normal while 87 cases of this series had protein levels ranging from 4.8 to 6.0 percent and they healed without disruption.

It must be remembered that the storage of proteins in the body, unlike fats and sugars, is relatively small, therefore protein deficiency will arise early in conditions of protein starvation or inanition. In cases of large abscesses or draining wounds the proteins of the body are depleted rapidly unless augmented by the intake of equivalent amounts of absorbable proteins. The hypoproteinemia, which seems to be incident to certain diseases of the digestive tract as well as suppurating wounds and major operative procedures, is best combated prophylactically by a diet high in proteins. It was stated by Elman (9) that 373 grams of protein are required each day for a period of 10 days to elevate the serum protein from 5 to 7 grams per 100 cc. It should be stressed that, when possible, preoperative preparation for 10 to 14 days at home is advisable in patients with a low serum protein. When internal administration is not effective or impossible, the commercially available casein digests should be administered.

In regard to carbohydrate metabolism it is well known that wounds in diabetic patients heal slowly, if at all. This has been shown experimentally to be true in pancreatectomized dogs. It was shown that there was edema of the tissues and a delay in fibroplasia as well as an excessive cellular reaction. When insulin is given to control the hyperglycemia and aid in metabolism of the sugar, the wounds heal normally. The relationship of sugar metabolism to protein is well known, when sugar is not available for metabolism the proteins are metabolized and consequently are not available for repair.

The role of vitamin C in wound healing is an interesting one. The effect of its deficiency was noted in Richard Walters' account of Lord Anson's Voyage Around the World in 1740 as found in Tice's Practice of Medicine. "Scars of wounds that had been for years healed were forced open * * * one of the invalids * * * who had

been wounded 50 years before * * * and continued well for a great number of years past, yet on his being attacked by scurvy, his wounds broke out afresh and appeared as though they had never healed. Aschoff and Kock (2) in 1919 in the study of this deficiency came to the conclusion that the lack of intracellular substance was the cause of poor healing. Wolbach and Hawes (24) in their paper published in the archives of pathology demonstrated that the histologic basis for the failure of wounds to heal in the presence of a deficiency of this vitamin is in decreased production and inadequate maintenance of intracellular substance by the supporting structures. Bartlett and coworkers (4) in 1940 showed in the study of surgical patients that there is a decrease in the concentration of the plasma ascorbic acid following surgical operations. Hartzell and coworkers from Detroit (10) state that in their experience 1,000 mg. of vitamin C intravenously is required for a 24-hour period if it is to be the only source. In their series of 20 cases of wound disruption all but 1 had a below normal plasma vitamin C. Hunt (12) of London in studies of 18 cases of deaths after the seventh postoperative day showed that most were deficient in this vitamin and 5 of these were cases where failure to form scar tissue was a contributory cause of death by facilitating disruption of the abdominal wound or leakage of the suture line in anastomosis of the gastro-intestinal tract. He states that they have reduced the incident of wound disruption by about 75 percent since the beginning of routine administration of ascorbic acid for all major abdominal operations.

Vitamin C or ascorbic acid may be given by mouth prophylactically in doses of 250 to 500 mg. daily but in cases where disruption is feared 1,000 mg. intravenously should be given on the day of operation and for several days following it.

SUMMARY

1. The initial treatment of the wound is of utmost importance for primary healing. Early and adequate débridement, care in ligating vessels and meticulous closure without tension is to be strived for.

2. Prophylactically powdered penicillin, while costly, is probably the best medication at the present time to use in a wound before closing.

3. The type of suture material seems to make little difference. We should use the smallest size to cause and to maintain approximation of the tissue. Mass ligation of tissue is to be avoided.

4. In the treatment of suppurating wounds, various antiseptics and antibiotics have been used and each is useful to some extent in reducing the amount of discharge. In this regard I believe it is important to change the antiseptic agent after approximately 5 days

because each agent has some selectivity for certain bacterial organisms and after this period, a type not so greatly affected by the agent begins to overgrow the wound. The simple procedure of changing antiseptic or bacteriostatic agents controls this.

5. Diabetes mellitus under control with diet or insulin is of little interference with wound healing.

6. The serum proteins should be maintained at an adequate level by oral or parenteral administration of proteins during convalescence from wounds either traumatic or surgical. Elective surgical patients should be prepared on a high protein diet for 10 to 14 days pre-operatively.

7. The vitamin C level should be maintained preferably by intravenous injections of 1,000 mg. of ascorbic acid on the day of operation and for several days following it in cases where difficulty may be expected.

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EXPERIENCES OF A MEDICAL OFFICER IN THE AIR TRANSPORT OF PATIENTS BY THE NAVAL AIR TRANSPORT SERVICE

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The first organized program for the transportation of patients by air within the naval organization was carried out in 1942 by MAG-25 and SCAT in the South Pacific Area. Since the Naval Air Transport Service was functionally analogous to MAG-25 and SCAT, their experiences as reported by Drs. Flaherty, Yavorsky, Yood, and McWilliams (1) served as a background and stimulus for the inauguration of hospital flights by NATS.

Although the Navy did not evacuate patients by air during the Attu campaign the NATS squadron then operating in the Aleutian area, VR-4, equipped its airplanes with litters and stood by at Adak in case its services might be needed. Subsequent to this campaign NATS began to transport a few patients. The first patients were NATS personnel who had become sick on the line or special patients of an en route medical activity who required immediate hospitalization elsewhere. For instance, an acute eye case might be brought from the Aleutians to Seattle. No separate records were kept on these early patients as they were not numerous, and they traveled as regular passengers.

Not until January 1944 did the demand for the transportation of patients become great enough to justify the operation of entire flights exclusively for hospitals. At that time the medical officer in command, Naval Hospital, Mare Island, Calif., requested that NATS operate special flights to transport violent mental patients to the United States Public Service Hospital, Fort Worth, Tex. An increased number of patients were arriving from overseas and special trains had become difficult to obtain. Surface transportation, when obtainable, required a large number of medical attendants and each trip tied up the attendants for about 2 weeks. There was also the possibility of poor publicity incident to the loading and unloading of psychotic patients before the general public.

Approval was obtained to move these patients by air, and flights were set up to provide a 2100 departure from Oakland. This provided

an overnight flight with an early morning arrival at Fort Worth. It entailed gas stops at Tucson and El Paso. Arrangements were made for the serving of refreshments to the patients at both stops by the American Red Cross or by purchases from the local airport restaurants. Fourteen patients were carried on each flight. The attendants consisted of a medical officer and seven pharmacist's mates provided by the hospital NP service. This large number of attendants was carried because the patients were violent manic-depressives or schizophrenics. Although arrangements were made with the Government medical facilities en route to accept the patients in an emergency, in most cases it was necessary that the attendants be adequate to provide a security watch and any needed medical care. Also there were, of course, a number of emergency fields en route into which an airplane might have been forced at which the attendants would have no outside help in caring for the patients.

The first flights under this program were begun in February 1944, during the height of winter weather throughout the Midwest and Rocky Mountain area. During this month 88 patients were transported. The figure increased to 154 in March, 198 in April, and 276 in June. These were all 1A psychotics, the most violent patients at Mare Island. The danger incident to transporting psychotic patients in an airplane was lessened by sedation and restraint of the patients to such a degree that they were incapable of causing a disturbance.

In June 1944, in addition to the trips operated for psychotic patients to Fort Worth, VR-4, the NATS squadron based at Oakland, Calif., was called upon to transport pulmonary tuberculosis patients from Oakland to Corona. These patients had been under treatment. Most of them had a pneumothorax; a few cases had bilateral pneumothorax. The transportation of these patients presented an even more serious problem than the psychotics, for their physical condition precluded operation of flights at ordinary operational altitudes. It was also obvious that these patients could not be flown over the Tehachapi Pass, which is about 5,000 feet high. Therefore it was necessary that the flights be routed off the civil airways, down the coast from San Francisco to Los Angeles, and then up the valley to Corona. By using this route the flights were operated at altitudes between 1,500 and 3,000 feet, which was a lower altitude than the patients would have reached had they traveled by train. Because flying was restricted in the coastal area, special permission was required to operate each of these trips. Of course, operation of these flights was possible only when the weather permitted flying under contact flight rules. One hundred and seventy-two tuberculosis patients were transported to Corona over the coastal route.

A NATS squadron, VR-5, was commissioned at Seattle in 1943 which absorbed the West Coast, Alaska, and Aleutian routes formerly operated by VR-4. This squadron continued to transport patients from the Aleutians as begun by VR-4 and, in early 1944, began transporting psychotic patients from the Naval Hospital, Seattle, Wash., to Mare Island. In June 1944 the rheumatic fever outbreak at Farragut, Idaho, was in progress. Transportation by train was too arduous for many of these patients, involving transfers at Portland, San Francisco, Los Angeles, and Barstow. VR-5 transported 423 of these patients to Corona, making gas stops at Klamath Falls and Oakland. On the return trip a number of malaria and filariasis patients were carried from various parts of the west coast to Klamath Falls.

The Naval Hospital, Seattle, sent a few cases of pulmonary tuberculosis, without pneumothorax, to the Naval Hospital, Oakland, Calif. via VR-5. On one occasion, a patient with pneumothorax was inadvertently placed on one of these flights. Fortunately, this occurred on one of the relatively rare days when the weather over the Siskiyou mountains was clear. The patient began to complain of pain in the chest and suffocation at 9,000 feet while over the mountains. The pilot was immediately informed of the situation. He descended as low as he dared, following the valleys, and eventually dived down the side of the last mountain into the Sacramento Valley in time to save the patient. As no serious cases were supposed to be aboard the only medical attendant was a hospital apprentice. He administered oxygen, of course, but was not prepared to decrease the pneumothorax.

The NATS transcontinental squadron based at Olathe, Kans., VR-3, began transporting patients in February 1944. These were mostly general medical and surgical cases from various places in the Midwest for the Naval Hospital, Great Lakes or the Naval Hospital, Norman, Okla. The demand for hospital flights by VR-3 expanded rapidly, their first important trips being to transport rheumatic fever patients from Bethesda to Corona. Government hospitals along the transcontinental route were contacted in order to insure accommodations in case of bad weather or mechanical difficulties and the American Red Cross units at en route commercial airports were contacted to assure refreshments for the patients. Excellent cooperation was received. The American Red Cross extended every courtesy and frequently opened their counters in the small hours of the morning to serve the patients.

VR-3 made several hospital flights between Mare Island and Philadelphia carrying blind and deaf patients. The eye cases offered no particular problem but some difficulties were experienced with the deaf, a few of whom had a pathological condition of the auditory tube causing trouble in the equalization of pressure in the middle ear on

descent. NATS therefore discontinued accepting this type of patient for the transcontinental trip.

In November 1944, when VR-4 became an engineering squadron, VR-3 took over completely the routes previously operated by VR-4 and assumed responsibility for operation of all transcontinental hospital flights.

The air transportation of patients as described so far was carried out on a special flight basis. In other words, it was not operated on a published schedule as are the present hospital flights. Each flight was individually authorized by the NATS wing commander and required separate arrangements throughout. Operation on a special flight basis was perfectly satisfactory as long as the volume of patients was small; in fact, it was preferable when transporting serious patients such as those with tuberculosis.

By the latter part of 1944, the volume of traffic had increased until the special flight system had become unwieldy and the setting up a published continental hospital flight schedule became almost a necessity. On 23 August 1944 NATS requested the Bureau of Medicine and Surgery to estimate the future needs for hospital flights in the States so that a schedule could be set up. A month later NATS representatives proceeded to Washington to confer with the Chiefs of the Professional and Aviation Medicine Divisions of the Bureau of Medicine and Surgery and representatives of the Chief of Naval Operations on matters pertaining to setting up a schedule, standardizing procedures for the processing of patients for travel by air, and space control of patients on hospital flights.

On 6 October 1944 the Chief of Naval Operations authorized a schedule as agreed upon by NATS and the Bureau of Medicine and Surgery. A few days later the Bureau published a directive to all continental hospitals which contained this schedule, directions to each hospital for contacting the local NATS representative, and designation of the airport to be used by each hospital. The first schedule was effective 10 November 1944.

Under the new schedule some minor difficulties were experienced which were more or less expected. The time lapse between the writing of the orders by the hospitals and signing by the commandants was excessive in some localities where hospitals were located at great distance from the district headquarters. This matter was referred to the Bureau of Naval Personnel by the Bureau of Medicine and Surgery, who, on 11 December 1944 authorized the medical officers in command of naval hospitals to sign travel orders for patients and attendants, including per diem.

There was often a lack of uniformity in orders as issued to the patients and attendants. Some of the issuing commands were not

aware of the fact that it was preferable, from a NATS point of view, to have the attendants remain on the airplane after delivery of patients, rather than have the attendants report to the hospital with the patients. For instance, if patients were deplaned at Dublin, Ga., which was off the passenger route, NATS preferred the attendants to remain with the airplane to Jacksonville, or Patuxent River, so they would be available to return to their permanent station as regular passengers. NATS experienced some priority difficulties in returning these attendants. NATS also encountered some difficulties feeding the patients at a few uncooperative commercial airport restaurants.

A conference was called in Washington in December 1944 to iron out these minor difficulties and to draw up an improved schedule, for NATS was now able to extend the service to include every naval hospital in the continental United States, including the special hospitals. As a result of this conference, sample orders for patients and attendants were issued by the Bureau of Naval Personnel; the necessary priorities for returning attendants were authorized; and the adoption of the meal ticket system as used on trains was authorized by the Bureau of Supplies and Accounts and all airport restaurants were so notified. These changes, plus the improved schedule, were distributed by the Bureau of Medicine and Surgery to the hospitals by letter dated 3 January 1945.

Many of the operational details of the transportation of these patients were briefly summarized in January 1945 and subsequently published in the *NAVAL MEDICAL BULLETIN* (2). In this report a plan for the air evacuation of casualties from the front was proposed, recommending that NATS squadrons in the Pacific Area be utilized. This was effected in March 1945 with the commissioning of a NATS air evacuation squadron overseas.

Between January 1944 and March 1945 VR-3 transported 2,137 patients; VR-5 transported 1,351; and VR-4 transported 1,410. The total number of patients transported was 4,898. Of these 2,229 were litter patients; 2,669 were ambulatory; 1,648 were mental; 3,022 were miscellaneous; and 228 were tuberculosis patients. In the performance of this transportation, 7.1 million patient-miles were flown. These figures do not include a small number of patients transported from Africa and Europe by NATS.

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SARCOMA OF THE SOFT TISSUES

Discussion and Report of Eight Cases

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The purpose of this presentation is to add emphasis to the generally recognized need for adequate pathological study of all tissue removed by the surgeon. Wood and Thomas (1) have previously stated that the course and chance of survival of the patient with neoplastic disease is frequently dependent upon the physician who sees the patient for the first time. The responsibility for proper therapy rests heavily on the medical officer who determines the regimen to be used. The Medical Department of the Navy, being fully cognizant of the importance of early diagnosis and early treatment of cancer, has established tumor centers in certain naval hospitals for the care of patients with malignant disease(2). These centers are equipped with the necessary facilities and consulting services which assure the best available therapy for the carrier of a malignant growth. To avoid delay in the institution of treatment, it is imperative that all records of operative and diagnostic procedures, x-ray films, radiation therapy factors, slides, and paraffin blocks be forwarded with the patient at the time of transfer to a Navy tumor center. During time of war, or when surgical procedures are performed aboard ship, the exigency of the situation may prohibit such transfer. Under these circumstances the removed specimen may be placed in a solution of 10 percent formalin which will preserve it almost indefinitely for subsequent pathological study. No surgical specimen should be discarded.

DIAGNOSIS OF SARCOMA OF THE SOFT TISSUES

Soft part malignancies may arise in nerve, fat, blood vessels, lymphatics, muscle, synovial membranes, and fibroblastic tissues. Farrow (3) has described these tumors as "symptomless, subcutaneous swellings with a history of being present for a long time, but only recently showing active growth." Cutler, Buschke, and Cantril (4) state that they are often encapsulated and tend to remain localized; however, as the tumor grows it becomes fixed to the surrounding structures. Sarcomas arising in the soft tissues may occur in any age group from infancy to the very old. The relationship to trauma is occasionally re-

ported by the patient; however, in most cases little association can be established between injury and the development of the neoplasm.

The more common locations seem to favor the extremities, but it must be stressed that they may arise in almost any anatomical region. According to Stout (5), when simple local excision is performed there is a high incidence of recurrence at the operative site, and subsequent metastases may occur by local invasion or lymphatic and blood stream dissemination. Any or all body organs may become infiltrated with metastatic disease.

Accurate diagnosis can be made only with the aid of the pathologist. A biopsy must be taken and interpreted before therapy is instituted. It is preferable to have the diagnosis of malignancy confirmed by immediate frozen section so that radical surgical procedures can be carried out while the patient is still on the operating table (6). However, if frozen section leaves any doubt, it is wiser to wait for permanent sections before proceeding with radical surgery.

It is not within the scope of this paper to review the many and varied histological types of malignant soft tissue tumors. Several cases are presented to illustrate the diagnostic difficulty often encountered, and stress the need for histological study.

CASE MATERIAL

The cases selected in this report consist of Navy patients, all of whom were seen at another activity before transfer to United States Naval Hospital, Brooklyn. They do not represent the sum total of soft tissue malignancies treated here, but rather are selected for purposes of demonstrating the problems which may be encountered.

CASE REPORTS

Case 1.—Local excision with recurrence 1 year later.—W. H. S., a 22-year-old white seaman, first class, was admitted to U. S. Naval Hospital, Brooklyn, on 24 May 1946, with the chief complaint of a firm, tender mass on the dorsum of the right foot. He was first admitted to the sick list at a fleet hospital in March 1945 with a tender swelling of the right foot which existed 3 months prior to enlistment, but which has shown tenderness only for 3 months. A clinical diagnosis of chronic bursitis was made, and the patient was transferred to a base hospital for therapy. In April 1945 the mass was excised. The postoperative course was uneventful, and 22 days after excision he was returned to duty. One year later the patient noticed a recurrent swelling at the former operative site, reported to sick bay, and was transferred to U. S. Naval Hospital, Brooklyn, with a clinical diagnosis of myxoma.

On admission, the general physical examination was normal with the exception of the right foot. On the dorsolateral aspect of the right foot, approximately 3 cm. from the lateral malleolus, there was a moderately tender, cystic, firm rubbery mass measuring 2 by 2 cm. in diameter. An x-ray of the chest was reported as showing no abnormalities, and an attempt at local excision on 1 June 1946 disclosed an infiltrating, gelatinous, reddish-brown tumor arising from the fascia

and spreading deep to the regional tendons. Frozen section examination was reported as being suggestive of sarcoma; however, permanent histopathological slides were awaited, and upon confirmation of the diagnosis an amputation was performed at the level of the midportion of the right tibia. The postoperative course was uneventful except for a small area of wound infection and sloughing which healed slowly by secondary intention. The prepared slides of the initial biopsy and postoperative specimens were examined by Dr. Arthur Purdy Stout, of New York, who established the diagnosis of fibrosarcoma of tendon sheath. Repeated examinations of the inguinal regions showed no remarkable lymphadenopathy, and numerous x-rays of the chest demonstrated no evidence of metastatic disease. X-rays of the stump disclosed a small sequestrum at the lateral margin of the tibia. The patient was discharged from the hospital in October 1946 for transfer to another activity for prosthesis. At the time of discharge, he was clinically free of recurrent or metastatic malignant disease.

Case 2.—Inflammation confused with neoplasm; difficult histological interpretation and history of trauma.—J. C. D., a 21-year-old white seaman, second class, was admitted to the U. S. Naval Hospital, Brooklyn, in January 1946 with a diagnosis of contracture, third, fourth, and fifth fingers, left hand. In March 1945, the patient struck his left arm against a depth-charge rack, sustaining injury to the middle one-third of the forearm. Following this trauma, he noted pain and swelling at the site of injury and progressive contraction of the fingers of that hand. X-rays of the forearm taken in July 1945 were negative. He was admitted to the sick list aboard ship in October 1945 and was immediately transferred to an air base hospital. Examination of the arm at this time showed "firm induration on the ulnar side of the middle one-third of the forearm" which was painful, tender, and warm, suggesting a cellulitis. X-rays were again negative. The inflammatory signs responded to local treatment in several days, leaving a firm mass which was fixed to the muscles and tendons of the forearm. In November 1945, he was transferred to an overseas naval hospital where a biopsy was performed. Two ounces of purulent odorless fluid were encountered, and many cystic areas were found in a mass which had infiltrated the muscle tissue. The biopsy was diagnosed as "Undetermined Type of Sarcoma." The patient was evacuated to the United States for admission to the Naval Hospital, Brooklyn. Slides of the biopsy accompanied the patient.

On admission in January 1946, the positive physical findings were confined to the left forearm. Inflammatory swelling and three draining sinuses involving the middle third of the forearm on the ulnar surface were present. Only mild induration and tenderness could be elicited by palpation, and the boundaries of the mass could not be well defined. Marked contractures of the fourth and fifth fingers and mild flexion deformity of the third finger were detected, with no evidence of sensory changes. Cultures of the draining wound showed hemolytic streptococci, and the patient was placed on a course of penicillin.

The submitted slides were reviewed by eight eminent civilian and Navy pathologists, and of these six diagnosed sarcoma and two reported that no malignancy was present. After 1 week of penicillin therapy, the lesion showed little, if any, improvement. X-rays of the forearm and chest revealed no pathological changes and repeat biopsy was attempted. The sinus tracts were excised exposing a mass measuring at least 10 cm. in length and deeply infiltrating the flexor muscles but not involving bone. A formal biopsy was taken and prepared slides were again submitted to the same pathologists all of whom concurred in the diagnosis of "fibrosarcoma, type unclassified." After first refusing operation, the patient consented to an amputation which was performed at the level of the junction of the middle and distal one-third of the humerus on 11 March 1946. Dissection of the

arm by the hospital pathologist showed a greyish-white fibrous tumor mass, 20 cm. long, running between the flexor carpi radialis and the palmaris longus muscles. The postoperative course was not remarkable and the patient was considered to be free of disease on 2 July 1946 at the time of his discharge to a prosthetic center.

Case 3.—Ten-year history; local excision with recurrence 2 years later.—W. E. L., a 21-year-old white Marine Corps private, was admitted to Brooklyn Naval Hospital, on 4 January 1947 with a diagnosis of liposarcoma, left leg. He stated that he had noticed a "walnut-size" mass on the inner aspect of the left calf for 10 years. In January 1945, following hospitalization after an automobile accident, the mass was excised locally at a civilian institution and a pathological diagnosis of liposarcoma was obtained. The operative report noted that the excision was performed with moderate difficulty as the base of the tumor was somewhat infiltrating in nature. The patient enlisted in the Marine Corps in May 1946 and since that time a recurrent mass gradually developed posterior to, and near the proximal end of the incision. He reported to the sick bay at another activity and upon receipt of the pathological report of liposarcoma, he was transferred to Brooklyn Naval Hospital for treatment.

On admission, the significant physical findings were confined to the left calf where two distinct masses could be palpated. One, measuring 10 by 6 cm., arose on the posterior aspect of the leg beginning in the lower popliteal fossa and extending approximately 10 cm. distally. This mass was firm, not attached to the overlying skin and not fixed to bone, but seemed to be incorporated in the body of the gastrocnemius. No tenderness could be elicited. The second smaller mass was elongated, cylindrical and involved the anteromedial aspect of the left calf. No fixation was noted. Slight tenderness could be produced with moderately firm palpation. No remarkable adenopathy was found in the inguinal regions.

A chest x-ray taken on the day of admission revealed a calcified primary complex and in addition, a small area of increased density at the level of the fourth anterior rib interspace, and another similar density in the rib space below in the axillary margin of the left lung field. The hospital radiologist did not consider metastases a likely possibility. X-ray of the left leg showed no bony involvement.

Consultation was held with Dr. Gordon McNeer and Dr. Jerome A. Urban, of Memorial Hospital, New York, both of whom recommended biopsy and frozen section study to be followed by local removal, if surgically possible. If local excision could not be done, the only alternative was amputation.

On 10 January 1947, under spinal anesthesia, an incision was made over the larger mass and biopsy taken from moderately soft, yellowish-grey tissue. Frozen section study diagnosed the lesion as definitely sarcomatous, and wide local excision was attempted. In a short time, it was realized that the tumor mass was so invasive and extensive that local excision could not be performed without sacrificing the major blood vessels.

The leg was redraped, and with a new instrument set-up a mid-thigh amputation was performed. Postoperative examination of the leg revealed a tumor mass 5.5 cm. in width, 10 cm. in length and 3.5 cm. in thickness infiltrating the gastrocnemius. The second tumor measured 6 by 2 by 2 cm. and was found at the medial border of the tibia. Microscopic examination by Dr. Fred Stewart of New York diagnosed the lesion as "spindle cell sarcoma—unclassified, suspicious of synovial or tendon bursa origin."

The postoperative course was complicated by partial wound separation which healed slowly and with great difficulty. A repeat chest x-ray 9 weeks after operation showed no change in the previously reported densities in the lung

fields, and in April 1947 the patient was discharged to a special center for prosthesis. (Receipt of a full operative report from the civilian hospital where the first excision was done described the original tumor as measuring 9 by 7 by 6 cm. but no mention was made of the extent of the excision.)

Case 4.—Soft tissue tumor simulating inflammatory arthritis and myositis; diagnosis made preoperatively by radiologist.—D. E. D., an 18-year-old white seaman, second class, was admitted to the Brooklyn Naval Hospital on 15 December 1946 with the chief complaint of "stiffness in the right calf and foot." One year prior to admission, a tarsal bone of the right foot was fractured and a cast applied. He was asymptomatic after removal of the cast for a period of 10 months at which time he began to complain of stiffness of the right knee and aching pains in the right calf and foot. He reported to a base dispensary on 6 December 1946 (2 months after onset of pain) where swelling of the right knee and 1 inch atrophy of the right thigh were detected. Upon transfer to a naval hospital, the pain became localized to the right popliteal space and motion was markedly limited. A firm tender mass was palpated lying within the boundaries of the popliteal space, and the overlying skin was red and warm. X-ray of the knee joint revealed the presence of a soft tissue mass on the postero-medial aspect of the shaft of the tibia, with periosteal reaction showing strands of calcification extending into the soft tissues. These findings, to the radiologist, were suggestive of malignancy and the patient was transferred to Brooklyn Naval Hospital.

On admission, the positive physical findings were confined to the right leg. The patient showed an 80° loss of extension of the right knee joint with no deficit in flexion. The knee was diffusely swollen and the enlargement appeared to be continuous with the calf muscles. In the popliteal space, a firm, moderately tender mass approximately 5 by 5 cm. could be palpated. No skin fixation was present. Shotty, small nodes were found in both inguinal regions. X-ray of the chest was negative.

On 17 December 1946 a formal biopsy was taken and a frozen section was reported as suggestive of sarcoma. Permanently prepared slides confirmed this diagnosis and amputation was performed on the following day at the level of the mid-thigh. The postoperative specimen revealed a 3 by 2 by 2 cm. homogenous soft, yellowish-white tumor mass lying in the fascia and extending through the muscle of the periosteum. Dr. Fred Stewart, of New York City, reported this as rhabdomyosarcoma. The tumor was shown microscopically to have invaded the bone and one adjacent lymph node.

The postoperative course was complicated by hematoma formation and necrosis at one angle of the wound which promptly healed by secondary intention. At the time of discharge to a prosthetic center in February 1947 there was no evidence of metastatic disease. In September 1947 the patient expired with widespread metastases.

Case 5.—Sarcoma confused with phlebitis; widespread metastases present at time of discovery of primary tumor.—E. E., a 44-year-old Filipino, cook, first class, was admitted to the surgical service of Brooklyn Naval Hospital on 29 August 1944 with a diagnosis of varicose veins, right leg. The patient was perfectly well until 5 days before admission at which time there was a sudden onset of pain and swelling of the right foot and leg immediately following exercise. There was no history of direct trauma, and no previous episode of swelling. Physical examination showed edema of the right foot, ankle, and leg, and a hard fusiform 7 by 4 cm. mass was palpated at the lower border of the gastrocnemius. A course of penicillin therapy and whirlpool baths provided little improvement and on

15 September 1944 an aspiration biopsy was performed. A pathological report of sarcoma was obtained. X-ray of the chest on 21 September showed nodular metastatic invasion of both lung fields. The patient was transferred to the Tumor Service where his subsequent course was ingravescent. Palliative radiation therapy was given to the primary tumor, to enlarged right inguinal nodes (which later developed) and to the chest. The patient expired on 11 February 1945 (22 weeks after admission). Post-mortem examination showed marked replacement of the pulmonary parenchyma by tumor tissue with no nodal involvement other than the right inguinal region. The final microscopic diagnosis was neurogenic sarcoma.

Case 6.—Synovioma confused with rheumatoid arthritis and "ganglion."—Y. J. L., a 20-year-old white seaman, first class, was admitted to Brooklyn Naval Hospital on 12 July 1944 with the chief complaints of intermittent attacks of redness, swelling, and tenderness of the right ankle of 15 months' duration. In spite of symptoms, the patient did not report to sick bay until 26 January 1944, while aboard ship. A clinical diagnosis of acute arthritis was made and he was transferred to a naval hospital. His symptoms and signs subsided spontaneously and he was discharged to duty on 14 February 1944, only to be readmitted 12 weeks later (3 May 1944) with a recurrence of his original complaints. On 16 May 1944 the right ankle joint was explored and a specimen of tissue excised. Microscopic examination was reported as "chronic granuloma, compatible with a rheumatoid nodule." The official diagnosis was then changed to "Tumor, Mixed, Benign. Granuloma, Right Foot" and the patient was transferred to Brooklyn Naval Hospital. The slides did not accompany the patient. His family history revealed the occurrence of rheumatic fever in one sister.

Examination on admission showed a well-healed scar over the right ankle joint with a small cystic swelling lying above the scar on the posterolateral aspect of the joint. Motion was only slightly impaired. An x-ray of the right ankle was negative for evidence of bone or joint pathology except for a moderate degree of decalcification particularly in the tarsal bones. Aspiration of the cystic area was productive of 2 cc. of serosanguineous fluid. The patient was given a complete medical workup including E. N. T. examination, agglutination tests for typhoid, paratyphoid, brucellosis and typhus, dental examination, prostatic smears, sedimentation rates, and routine laboratory tests, all of which were of no help in establishing an etiological agent. The cystic mass recurred and the patient was taken to the operating room for a "ganglionectomy" on 9 August 1944. At operation, a "large, irregular, friable, granular mass, bluish-violet in color" was found infiltrating the soft tissue and joints between the astragalus, os calcis, and lower end of the tibia. A large portion of the mass was excised which on microscopic examination was reported as synovioma. An x-ray of the chest showed no evidence of metastatic disease. On 21 August, an amputation of the right leg 6 inches below the knee was performed. Following a normal postoperative course, a prosthesis was fitted and the patient was transferred to a convalescent hospital on 17 October 1944. At the time of transfer, there was no evidence of recurrent disease.

Case 7.—Radiographic diagnosis; Local excision with recurrence.—L. F. M., a 28-year-old white carpenter's mate, third class, was admitted to Brooklyn Naval Hospital on 2 February 1945 with a diagnosis of sarcoma of the right thigh. In September 1944 the patient first noticed some swelling of the upper part of the right thigh. Two months later, pain occurred in the same region and he reported to a dispensary where an x-ray of the right femur was taken. Radiographically, an area of thickened cortex and periosteal proliferation suggestive of a new growth was noted. On 30 December 1944 a firm, well-encapsulated tumor was excised

from the anterolateral aspect of the right femur. The bone adjacent to the mass appeared sclerotic. It was believed that the tumor was excised in toto along with periosteum. Pathological report by Dr. Charles F. Geschickter stated that the tumor was a synovial or capsular sarcoma, and the patient was transferred to Brooklyn Naval Hospital.

On admission, the positive physical findings were localized to the right lower extremity. On the anterolateral aspect of the thigh, there was a longitudinal scar 13 inches long with four purulent draining sinuses. No tumor masses could be palpated; however, slight enlargement of the right inguinal nodes was noted. An x-ray of the chest was negative for metastatic disease, and an x-ray of the right femur showed no bony changes.

Within 1 month's time, under a regimen of continuous wet dressings, the wound completely healed. The patient's general condition was good, and since there was no evidence of recurrence of the tumor, immediate surgery was not contemplated. On 21 July 1945 (6 months after excision), the patient returned from leave complaining of pain at the operative side. Repeat x-rays disclosed "slight irregularity in outline along the lateral margin of the upper shaft" of the right femur over a 6-inch area. A fusiform enlargement could be palpated just below the greater trochanter on the right side. Aspiration biopsy of the mass revealed malignant unclassified neoplastic tissue. In view of the fact that synovial sarcoma is extremely radioresistant, it became evident that only with a radical surgical procedure could any hope of cure be offered to the patient. Consent for operation was not granted until 6 October 1945 when interilio-abdominal amputation of the right lower extremity was performed. Histopathological examination of the lesion disclosed synovial sarcoma involving the shaft of the femur. The residual tumor mass measured 15 by 10 cm. and chiefly invaded the soft tissues surrounding the femur. Convalescence was normal and healing was complete. Repeated examinations over a period of 7 months disclosed no evidence of recurrent or metastatic disease and the patient was transferred to another activity for prosthesis on 2 July 1946.

Case 8.—Two local excisions with recurrence; rhabdomyosarcoma confused with benign cyst.—L. W. S., a 23-year-old white apprentice seaman was first admitted to the sick list on 20 September 1943 after 1 day of active duty. In March 1943, a small mass in the midportion of the back was noticed by the patient's wife. The mass grew larger, firmer, and increased in tenderness. His family doctor excised the lesion in June 1943, as an office procedure, and told the patient it was a "dermoid cyst." (No histopathological sections were made.) Within 3 or 4 weeks the mass recurred, but the patient's doctor had gone into service. The patient went to a civilian hospital where he was told that the mass should be removed and that he would be notified when a room was available. Before notification arrived, he was inducted into the naval service. On 15 September he reported for duty and following physical examination, he was immediately referred to a naval hospital.

On admission, the general physical examination was negative except for a mass overlying the eleventh and twelfth dorsal vertebrae just to the left of the midline. The mass measured approximately 6 by 4 cm. and appeared fixed to the deeper structures. The consistency was firm and elastic and overlying the mass was a well healed scar. X-rays of the spine, chest, and long bones, as well as intravenous urographic studies were normal. On 27 September 1943 a complete excision of the mass was performed and specimens sent to the U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md., were reported as rhabdomyosarcoma (Dr. Charles F. Geschickter). The postoperative course was uneventful and the patient was transferred to Brooklyn Naval Hospital on 23 October 1943.

On admission, no evidence of recurrent or metastatic disease could be detected. The patient was observed for a period of 2 months and recommendation was made for discharge from the service. Simultaneous with the arrival of the discharge papers, a 1 by 2 cm. nodule was noted in the scar at the level of the tenth dorsal vertebrae. On 21 January 1944, a wide excision was performed and a diagnosis of sarcoma confirmed histologically. The wound healed completely and the patient was discharged, clinically free of disease, on 18 February 1944.

TABLE 1.—*Tabulation of data presented in case reports*

Case	Age	Sex	Site	Diagnosis	Duration before consulting doctor
W. H. S.	22	Male	Foot	Fibrosarcoma	11 months.
J. C. D.	21	do	Arm	do	2 months.
W. E. L.	21	do	Leg	Spindle-cell sarcoma	10 years.
D. E. D.	18	do	do	Rhabdomyosarcoma	2 months.
E. F.	44	do	do	Neurogenic sarcoma	5 days.
V. J. L.	20	do	Foot	Synovioma	10 months.
L. F. M.	28	do	Thigh	do	2 months.
L. W. S.	23	do	Back	Rhabdomyosarcoma	3 months.

Case	Local excision	Recurrence	History of direct trauma	Amputation
W. H. S.	Yes	1 year		Yes.
J. C. D.	No		Yes	Yes.
W. E. L.	Yes (?)	2 years		Yes.
D. E. D.	No		(?)	Yes.
E. F.	Metastases present			
V. J. L.	Yes	2 months		Yes.
L. F. M.	Yes	5 months		Yes.
L. W. S.	Yes	4 weeks		
	Yes	3 months		

TREATMENT AND PROGNOSIS

It is impossible to establish specific rules to govern the treatment of every individual case of sarcoma. In some instances wide local excision has proved effective in producing a long-term cure, and in others, the amputation of an extremity was followed by death due to metastatic disease in a relatively short time. It is hoped that rapid diagnosis and prompt treatment will provide a higher rate of cure and a diminishing number of mutilating operations.

Radiation therapy has proved to be of little value when used alone in most cases; however, some authors believe in its application when combined with surgery.

At the present time the relatively scarce literature on the subject presents an extremely unfavorable outlook in the vast majority of cases, regardless of the method of treatment. To what extent this is due to delay in diagnosis and inadequate treatment can only be disclosed by subsequent reports.

It is regrettable that follow-up information of the reported cases is, at present, not available. One case died in the hospital with evidence of metastatic disease which was present at the time of admission. Four cases have been subjected to surgery too recently to be of statisti-

cal value. Of the remaining three, one case (case 7) is known to have hopelessly advanced metastases. The condition of the other two cases is unknown.

SUMMARY

1. Eight cases of soft tissue malignancy are presented to illustrate problems encountered in diagnosis.

2. Surgically excised tissue should be subjected to histopathological study in all cases. The use of 10 percent formalin to preserve specimens for later study is suggested.

3. Subcutaneous masses should be considered malignant until proved otherwise by biopsy and pathological interpretation. Increased usage of the frozen section method of examination will allow immediate radical surgery in more cases.

4. The responsibility for adequate treatment often rests upon the physician who initially examines the patient. Early diagnosis and early treatment cannot be emphasized sufficiently.

5. It is recommended that histopathological slides and all available data accompany the "tumor patient" upon transfer to another activity.

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MUCOUS MEMBRANE GRAFTS FROM THE INFERIOR TURBINATE IN RECONSTRUCTION OF THE ORBIT

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Extensive trauma of the globe and orbit is usually brought to the attention of the ophthalmologist and plastic surgeon soon after the injury has been sustained so that it is possible to take immediate steps to minimize deformity of the eyelids, to remove the destroyed globe or global fragments, and to preserve sufficient concavity of the orbital contents for the accommodation of a prosthesis (1). Wherever medical facilities are inadequate or unavailable, months or years may elapse between the time of orbital damage and the time of surgical intervention. Plastic repair may then tax the utmost ingenuity of the surgeon.

Chief among the sequelae of neglected orbital injuries are extensive scarring with cicatricial contraction, deformity and fixation of the eyelids, and abnormal tissue masses within the socket. The inordinate proportion of fibrous tissue not only enmeshes remnants of the globe but, in the course of subsequent contraction, accounts in large measure for the shrinkage of the orbital soft tissues. Usually the eyelids are so bound down by adhesions to the shrunken orbit that little if any palpebral conjunctiva remains. Obviously, most of these unfortunate and disfiguring sequelae could have been prevented or minimized by prompt repair based upon sound anatomic principles.

Cosmetic considerations in delayed total repair of the socket call for restoration of the eyelids, elimination of disfiguring cicatrices, removal of residual portions of the destroyed globe and provision of an epithelial-lined pocket in the orbit to accommodate a prosthesis. After excision of cicatrices and freeing of the eyelids from their firm attachments to the shrunken orbit, the fragments of the globe are identified and removed. Especial pains are taken to remove all granulations, excise all scar tissues, and to eliminate all cavities resulting from such excision by the introduction of buried sutures. These precautions assure the proper preparation of the orbital bed for the reception of the graft. A recess sufficiently ample for the accommodation of a prosthesis is thus provided but in some instances,

when the contents of the orbit are excessive, additional orbital tissue must be removed.

Since most, and often all, of the palpebral conjunctiva has been replaced by fibrous tissue, epithelialization of the inner surfaces of the eyelids is necessary to provide mobility and a conforming contour for contact with the prosthesis. In addition, it is necessary to epithelialize the orbital bed. Skin grafts, or grafts of mucous membrane, have long been used for this purpose. For obvious reasons, a graft composed of a single sheet of tissue is preferable to multiple grafts. While skin grafts are readily obtainable in a single sheet of considerable area, their color and texture are somewhat incongruous in the orbit. On the other hand, mucous membrane grafts derived from the lip or the buccal surfaces are less recalcitrant than skin grafts, produce a more pliable epithelial lining, and most closely resemble normal conjunctiva in color but must be used in the form of multiple grafts. Most nearly meeting the requirements is a single mucous membrane graft which is appropriate in surface area, texture, and color. Such a graft has been obtained by removing one-half to two-thirds of the middle turbinate, and justified on the grounds that the color of the membrane is suitable for the orbit and that, when separated from the turbinate, the membrane is so thin that it may be employed without paring (2) (3).

A still more extensive sheet of mucous membrane, to be used as a single graft, can be obtained from the inferior turbinate. While sacrifice of a large portion of an inferior turbinate is regarded with disfavor by many rhinologists, in actual practice little if any disability or discomfort follows such removal. For many years, a number of rhinologists have removed the major portion of the inferior turbinate during the Caldwell-Luc operation on the basis that the removal helps to perpetuate the naso-antral window. No demonstrable, deleterious after effects have been reported. If the academic objections to the removal of a portion of the inferior turbinate are ignored, a sheet of mucous membrane may be obtained which is more than adequate for the epithelialization of the inner surfaces of the eyelids and of the orbit. The mucosa of the inferior turbinate is more elastic and less fragile than that of the middle turbinate. It can be obtained in larger sheets with less trauma to contiguous structures and without sacrifice of or damage to olfactory areas. The inferior turbinate is the most accessible of all the turbinal structures. The cosmetic result with such a graft justifies the procedure.

TECHNIQUE

Topical application of 10 percent cocaine hydrochloride in 1:5,000 epinephrine solution is made to the entire inferior turbinate, the floor

of the nose, and the septum. The inferior turbinate is then ballooned out by a single injection of 2 percent procaine hydrochloride containing 10 minims of 1:1,000 epinephrine per ounce of solution. By means of a Struykens nasal cutting forceps, as much of the inferior turbinate as is necessary to provide the desired area of mucous membrane is separated from the lateral nasal wall. Usually, the anterior two-thirds is ample and the posterior third remains to carry on the functions of the turbinate. The actual separation of the anterior two-thirds from the posterior third is rapidly accomplished by means of a nasal snare or, better yet, a small tonsil snare which accommodates a heavier and more reliable cutting wire. The excised portion of the turbinate is then removed in one piece by grasping with forceps or teasing it out with a Frazier suction tip.

The exposed turbinal bone in the separated turbinate is clamped in a hemostat to provide fixation while the mucous membrane is removed as a continuous sheet by sharp dissection. The sheet of mucous membrane will be found to stretch to a surprising extent, a property which is a distinctive feature of membranes normally covering erectile tissue. The graft is now trimmed to an appropriate size and shape so as to cover the orbital surfaces and extend over the inner surfaces of the eyelids to the line of surviving palpebral conjunctiva. There should be neither undue tension nor redundancy when the graft is fitted into place. Both the inner surfaces of the lids and the orbital bed are covered with a thin film of sulfathiazole powder before the final application of the graft. Four anchor sutures are used to secure adherence of the graft to the orbital tissues. These should be of absorbable material. In order to obtain satisfactory repair of the lids, the graft must be sutured to the vestiges of the palpebral conjunctiva with great accuracy. In addition, two mooring sutures of silk are placed cross-wise in each lid for nearly the entire extent of the palpebral portion of the graft, and then carried through to the external lid surface. The surface of the graft is then coated lightly with sulfathiazole powder and a temporary prosthesis introduced. The latter may be prepared from acrylic resin or other suitable material but must be so shaped that it exerts uniform pressure against the portions of the graft lying within the orbit and at the same time fits uniformly against the portions of the graft applied to the lids. After suturing the lids together, a light pressure bandage is applied. After 48 hours the bandage and the mooring sutures are removed. On the third day the prosthesis is removed and sterilized, the cavity is irrigated with sterile normal saline solution and after lightly coating the mucous surfaces with sulfathiazole powder, the prosthesis is reintroduced. The sutures maintaining approximation of the palpebral conjunctiva and the graft are removed on the fifth day. Thereafter, daily irrigation of the socket

is carried out while the prosthesis is cleansed. The surfaces of the graft are again covered sparsely with sulfathiazole powder before reintroducing the prosthesis. After 4 or 5 weeks the permanent cosmetic prosthesis can be fitted and worn.

CASE REPORTS

Case 1.—Attention was first drawn to the inferior turbinate as a source of mucosal grafts in the case of a French civilian, aged 51 years, who was admitted for treatment 6 months after a stick of dynamite had exploded while being held in his right hand. The immediate results of the accident were loss of the right arm, extensive lacerations of the anterior thorax, face, and eyelids, fragmentation of the left globe and multiple foreign bodies in the right globe. Although he had recovered from his major wounds concern was manifested for the right eye in which only light perception could be demonstrated. This eye was found to contain particles of explosive distributed in the cornea, iris, and lens; there was iridodialysis and a traumatic cataract had formed. The retina was shown to be intact by examination with the direct roentgen beam (4). On the left, the eyelids were bound to the shrunken socket by dense adhesions so that only a marginal strip of conjunctiva remained. In addition there were numerous scars of both lids. Among the measures to be undertaken, total repair of the left orbit was indicated because of cosmetic considerations.

The patient complained of a persistent left-sided nasal obstruction. Examination revealed a deviation of the septum to the right and a greatly hypertrophied inferior turbinate completely obstructing the left nostril. Since a mucosal graft was needed for repair of the right orbit, it was felt that removal of the left inferior turbinate would provide an adequate single graft and at the same time relieve the left-sided nasal obstruction. The mucosal graft thus obtained was so extensive in area, and when applied to the orbit and lids survived so readily, that the procedure seemed worthy of further trial.

Case 2.—A male Polynesian, aged 24 years, was admitted 16 months after receiving a destructive laceration of the left globe during a fight in which his opponent was armed with a bayonet. In addition to the loss of the globe there was scarring and deformity of the eyelids and a shrunken socket. Only a few global fragments remained. The lids and orbit were prepared for reception of a graft which was prepared from the normal right inferior turbinate and obtained in a single sheet of mucous membrane. Survival of the graft was uneventful and an artificial eye was provided to replace the temporary prosthesis 4 weeks later.

Case 3.—A male Mexican, aged 37 years, was examined 10 months after a boiler explosion had resulted in lacerations of the right upper and lower eyelids and destruction of the right globe. After freeing the eyelids and excising various cicatrices, the shrunken orbit was prepared for the reception of a graft. The turbinates appeared entirely normal. The left inferior turbinate was selected as the source of a graft. Removal of the mucosa of the inferior turbinate provided a single sheet of mucous membrane which was sufficient to cover the orbital bed and extend over the denuded portions of the inner surfaces of the eyelids. The graft survived without complications and an artificial eye was provided 6 weeks later.

The gratifying results in case 1 prompted the use of a single graft taken from the inferior turbinates in case 2 and case 3, of which both

patients had destructive injuries of the orbit requiring delayed total repair of the socket and lids, and this in spite of the fact that the turbinal structures appeared normal. No subjective symptoms, attributable to the removal of the major portion of an inferior turbinate, have been experienced by the three patients after the lapse of more than 3 years. Crusting which appears at the site of separation of the turbinate from the lateral wall of the nasal chamber ceases as soon as epithelialization is accomplished. In at least one of the three patients (case 1), removal of the inferior turbinate effected improvement in nasal respiration.

The source of choice for small mucous membrane grafts continues to be the mucosa of the lips or that of the buccal surfaces. Only when a single, large-area mucous membrane graft is required should turbinal structures be sacrificed. The end should justify the means. The physiological functions of the nose are no more impaired by the removal of the inferior turbinate than they are by the removal of the middle turbinate. The advantages of greater accessibility and greater surface area recommend the inferior turbinate as a source of extensive mucosal grafts.

CONCLUSIONS

1. A single large-area mucous membrane graft is superior to small, multiple grafts in total repair of the orbit.
2. Accessibility and greater surface area render the inferior turbinate more desirable than the middle turbinate as a source of single, large-area mucous membrane grafts.
3. Three patients fail to exhibit disability due to the sacrifice of inferior turbinal tissue after the lapse of more than 3 years.

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INSTRUMENT STERILIZATION IN DESERT COUNTRY

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Experiments were conducted to determine the advantages of oil sterilization under desert conditions. Inasmuch as water methods of sterilization have many disadvantages under field conditions, an attempt was made to determine the value of oil as a substitute for water.

METHOD

The method of water sterilization was that which is in common use in the United States Navy: Noncutting instruments were washed with soap and water, then immersed in water, and boiled for 10 to 15 minutes, then cooled in 70 percent alcohol.

Oil sterilization procedures were carried out according to the method outlined by Gerald L. Parke,² Commander (DC) U. S. N.

The cleansing solution was prepared as follows:

	<i>Percent</i>
Carbon tetrachloride.....	50
Liquid petrolatum, U. S. P.	50

A Pelton-Crane sterilizer with the thermostatic control disconnected was used with 2 quarts of liquid petrolatum U. S. P., heavy, as a medium. A model 214 can be employed.

The handpiece was operated in the cleansing solution for 1 minute and then placed in the hot petrolatum bath, 250°–300° F., where it remained for 5 minutes. After removal it was hung to dry from a suitable rack, and drained over a piece of gauze or towel.

Contaminated instruments after washing were placed in the hot oil bath, 250°–300° F., and sterilized similarly to the handpieces. When the instruments had sufficiently cooled and drained they were wiped dry with a sterile towel.

All instruments were contaminated with the common mouth flora and cultured before sterilization, and after boiling cultured again.

¹ U. S. Naval Medical Research Unit No. 3, Cairo, Egypt.

² PARKE, G. L.: Sterilization and lubrication of dental handpieces. U. S. Nav. M. Bull. 45: 955–959, November 1945.

Respective instruments which were subjected to water and oil sterilization were partially dried and exposed to the elements: wind, sand, moisture, and sun. Each day for a period of 1 week they were examined for corrosion.

The test sample of water from the Cairo, Egypt, water supply was analyzed to determine the relative amounts and properties of suspended matter, temporary hardness, and total dissolved solids (table 1).

A series of six relative sterile oil contaminations were made to wounds. The wounds were examined for any abnormal reactions.

RESULTS

TABLE 1.—*Analysis of water used for sterilization (first and second samples)*

	<i>Quantity</i>
Suspended matter.....	Negligible.
Temporary hardness, $\text{Ca}(\text{HCO}_3)_2$, $\text{Mg}(\text{HCO}_3)_2$	Negligible.
Total dissolved solids.....	154 parts per million.

The water was found to contain such small quantities of suspended matter and constituents causing temporary hardness that analytical determination was impossible. Further studies of desert water may offer some insight into its corrosive properties.

TABLE 2.—*Comparative value of oil and water*

	Oil	Water
Relative sterility.....	Good.....	Good.
Lubricative value.....	do.....	None.
Corrosion.....	None apparent	Heavy (appears within 24 hours).
Cleansing properties with carbon tetrachloride.....	Good.....	Slight.
Sterilization technic.....	Simple.....	Simple.
Time involved for sterilization, drying.....	7-10 minutes.....	10-15 minutes.
Tissue tolerance.....	Good.....	Good.
Conservation of space and water supply.....	do.....	Poor.

SUMMARY

1. Cultures from both methods of sterilization proved to be relatively sterile.

2. Oil sterilization was superior in its value to lubricate; it reduced maintenance and repair of handpieces; eliminated the necessity of disassembling handpieces before sterilization; prolonged the life of mouth mirrors, the cutting edges of instruments, and the sterilizer.

3. There were no deposits of the oxides (corrosion) such as is experienced with boiled water upon instruments or in the sterilizer. Thus corrosion or rusting is at a nonreducible minimum. As the test water sample was obtained from the Cairo area one would expect to encounter more undesirable constituents of desert water in the field.

4. There were no apparent ill effects of oil contamination to wounds.

5. The use of oil as a medium of sterilization conserves valuable water supply and transportation.



DENTAL INACTIVATION IN THE RESERVE FLEET

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The end of the war and the diminished need for many ships in the active fleets created the problem of establishing Reserve Fleets. These surplus ships had to be protected against the action of the elements as represented by rust and corrosion. Consequently, a number of directives were issued pertaining to the care of idle ships. The two Reserve Fleets (Atlantic and Pacific) were divided into groups and subgroups as berthing spaces were made available. Personnel, most of them inexperienced at this new task, were assigned to actively retire these ships and place them in an adequate state of security and preservation. When the exigencies of the service permitted, dental officers were assigned to the various groups to assist in the general program as related to the dental activities aboard the ships.

The following discourse is submitted to better acquaint the reader with the actual procedure practiced in placing these ships out of commission and keeping them in a state of semireadiness for immediate service.

Of the hundreds of ships that will ultimately find their final berth in the San Diego group, Pacific Reserve Fleet, some 35 of them have dental departments abroad. These include ships such as communication ships, with a single dental operating room; repair ships, with two dental operating rooms and a dental prosthetic laboratory, and hospital ships, with three dental operating rooms and a dental prosthetic laboratory. Although the dental organization on each ship may be different, the flexibility of the inactivation procedure is such that it may be carried out in a standardized manner.

To better present the inactivation procedure the various steps will be described in sequence. Explanatory remarks will be submitted where needed.

Current directives have indicated the need for expediting the entire program, hence, when a dispatch is received naming a ship or ships to be assigned to this group, a prepared folder is forwarded to the ships' dental officer to give him an insight into the various steps that must be completed before his department may be considered 100 per cent inactive. It is hoped that prior to the actual reporting of his

ship to this group a fair proportion of the work will have been accomplished. However, due to critical personnel shortages and the oftentimes short period of notice before reporting, this is usually impossible. Thus, it is expected that when the ship arrives, the dental department of the Reserve group must shoulder most of the task.

An arrival inspection is conducted when the ship ties up at the Naval Station, San Diego. At this time an examination is made of the progress to date and a request is made for the utmost cooperation of the dental department aboard. If available, a team of two experienced men is assigned to the vessel to carry out the prescribed inactivation procedure. With the assistance of the dental officer aboard, the portion of the inactivation that has been completed is checked for accuracy. Should any discrepancies exist, they are corrected before proceeding.

The next step, best performed by the ship's force, is a thorough and accurate inventory of all supplies and equipment on hand. The results of this inventory are entered on each ledger and recapitulation sheet in the custody of the dental officer. With this information in mind, a comparison is made with the current commissioning allowance for the type ship and the items deficient are entered upon a requisition to bring the inventory up to a full commissioning allowance. This is necessary as directives on hand require that ships of the Reserve Fleets carry the same allowance as a ship going in commission for the first time. However, to differentiate between this type of requisition and those submitted by ships of the Active Fleet a phrase is included to the effect that this form is to prepare the vessel for inactive status. As with all other forms these requisitions are screened by the Reserve group staff dental office for accuracy.

Having completed this task, attention is turned toward the precious metals (for those ships having prosthetic laboratories), and to those items subject to deterioration, such as procaine hydrochloride and rubber dam. It is expected that ships of the Reserve Fleets will be subject to a long period of idleness and some may never be used again; therefore deteriorative items must be removed. For security reasons the precious metals are best kept in a naval supply depot. However, to facilitate reactivation, should it ever occur, information requisitions are forwarded to the Bureau of Medicine and Surgery to replace these items.

To further correct the inventory, all equipment that is broken, missing, or worn out, is surveyed. Only those articles of equipment carried on the current Catalog of Navy Material are replaced.

The actual physical preservation measures must be thoroughly carried out. The dental instruments, such as chisels, hoes, and hatchets are scrubbed with soap and water and dried. They are then dipped in

a fingerprint neutralizer, followed by an immersion in Grade 2 preservative (tetrol). A second coat is applied 24 hours later. In the set of instructions a word of caution is inserted at this point. During the period of use of the preservative indicated above, it is well to have adequate ventilation as the fumes arising from this formula are quite dangerous to inhale. Corresponding sets of instruments are then wrapped together in waterproof paper, labeling the outside of the package with the stock number and amount in each package. The instruments are boxed and stowed in a space assigned to the commanding officer as a dental storeroom. The latter is required by Sec.Nav. Ltr. Op 21D-JC, Serial 3369p24, Paragraph 6, of 27 June 1946.

All expendable items such as burs, sandpaper disks, etc., are neatly boxed, labeled as to content, and then stowed in the designated area. Metallic articles such as matrix bands, suture needles and knife blades are wrapped in waterproof paper with a small portion of silica gel (desiccant) inside to absorb moisture. The dental towels and smocks are secured in the standard waxed paper bags and also placed in the dental storeroom. Professional books are dusted, enclosed in waxed paper, and stacked in the available cabinet space in the dental office. The use of the waxed paper is a double precaution as the compartment housing the dental office is under dehumidification constantly.

The exposed metal surfaces as well as all porcelain surfaces are coated with a finger print neutralizer and then preserved with the customary two coats of Grade 2 preservative. The painted surfaces such as on the dental unit and x-ray machine are covered with a coat of wax. Diligence is exercised in the covering of the various surfaces so that the coating will not be thick. Again the thought is brought to mind that this will not be easy to remove should the ship ever be re-activated. After a thorough check of the entire office to see that the physical portion is complete, the team of men is instructed to titivate the office, thus finishing the work aboard ship.

Due to the presence of better facilities for ledger adjustment in the office of this activity they are brought off the ships for accounting procedures. All other files and records with the exception of the above-mentioned ledgers and property records are sent to the Naval Records Management Center for safekeeping. Upon recommissioning the records will be returned to the ship for the information of the new dental officer.

One of the most important phases of the entire program is the preparation of a key, showing the exact location of each item of equipment and supplies. From time to time the Bureau of Medicine and Surgery issues certain changes to the supply table in the form of additions and deletions. Should a specific item be deleted, one has only to check the

key to ascertain its location. Copies of this key are sent to the Bureau of Medicine and Surgery, with one being kept on board in a conspicuous place in the dental office.

There is also a space on the back of each ledger sheet for entering the location of the article.

The change from old to new stock numbers in July of 1946 obviously created the need for extensive ledger adjustment. To accomplish the change in the most efficient manner, the ledgers are first checked as to balance in all of the old classes. This task may be classed as either difficult or easy, depending upon the length of time the ship has been in commission. The files are gleaned for any surveys, priced invoices, or transfer vouchers that might not have been entered.

When the books have been suitably balanced according to the old numbers, the assignment of new stock numbers is undertaken. However, it is found that certain numbers have been deleted in the new catalog. Directives on hand state that arbitrary numbers shall be assigned these deleted items. The assigned numbers should be as near to the number of a corresponding item in the new catalog as possible. Another radical change in the catalog issued in July of 1946 was that of making a number of formerly nonexpendable items now expendable. This necessitates the preparation of a Transfer Voucher Issue (Form 127), followed in turn by an appropriate entry on the recapitulation sheets affected by the transaction.

The creation of several new classes of equipment calls for a complete rearrangement of the ledger. The main sections are divided into expendable and nonexpendable with the various classes being placed in the proper order numerically.

Due to the fluctuation of prices on the present-day market, the Navy has found it necessary to change several unit prices. Consequently these price adjustments must be carried on to the ledger in order to bring it up to date.

Having made these entries and deletions, the ledger is now considered correctly balanced and adjusted. The remaining step is that of making out the Journal of Receipts and Expenditures. This form as well as most of the others used in the Navy Medical Department system of property and accounting are relatively new to the personnel of the Dental Corps. Prior to June 1946 the bookkeeping of the entire Medical Department was handled by technicians familiar with these practices. However, since that time the Dental Corps has assumed this responsibility. Consequently, the Journal of Receipts and Expenditures must be made out anew by this activity. On a majority of the ships reporting, the first entry will be that of transferring the custody of all dental equipment and supplies from the Medical to the Dental Department.

Although this completes the ledger work and also the inactivation of the ship, the receipt of material from the medical supply depot from time to time, requires the reopening of the ledgers for written acknowledgment. Further stowage is also necessary.

For security reasons the final custody of all dental equipment and supplies is transferred to the commanding officer of the subgroup of which the ship is a part, and the ledgers are returned to the dental office.

Throughout the entire program of inactivation, neatness, accuracy, and the standardization of procedures have been stressed above all else. It must be continually borne in mind that these dental departments may be placed back in commission in the future. The ease with which this can be accomplished depends upon the thoroughness of our program.



OBSTETRICS ON GUAM

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Prior to the Japanese occupation of Guam only 1 prenatal clinic was established on the island. This clinic was located at the civilian hospital in the capital city of Agana. From a population of over 25,000, approximately 125 to 150 obstetrical cases were registered for prenatal care. Since the midwives delivered most of the patients, the number of hospital deliveries seldom exceeded 15 per month. During the interim of 1 December 1940, to 1 December 1941, 958 patients were delivered, with 2 maternal and 48 still-born and neonatal deaths. The gross infant mortality rate was 5.0 percent. Data for a corrected rate were not available.

During the 2 years and 8 months of the Japanese occupation of Guam, no records of births nor of maternal and infant deaths were preserved. Informants stated that both the maternal and infant death rates were exceedingly high; prenatal clinics were not held and most of the patients received very little medical attention. Only an occasional mother was delivered in the hospital. Six cesarean sections were performed by the Japanese doctors; three patients succumbed, establishing a maternal death rate of 50 percent for cesarean operations. After interviewing numerous obstetrical patients, the infant death rate was estimated to be 15 to 20 percent.

A prenatal clinic was reestablished at the civilian hospital, Agana, in December 1944. By March 1945, prenatal clinics had been established at 11 other villages: Inarjan, Merizo, Umatac, Dededo, Sinajana, Agat, Santa Rita, Yona, Talofofo, Barrigada, and Anigua; the clinic at the latter village was discontinued in September because most of the patients were moved to larger villages where they attended their respective clinics. On 1 September 1945, from a population of approximately 21,000, 502 patients were registered for prenatal care. The clinics, conducted by the obstetrician, were held weekly in the larger villages and fortnightly in the hamlets. Native nurses, midwives, and Navy hospital corpsmen ably assisted in the prenatal clinics. The patients cooperated wholeheartedly in registering at the clinics and eagerly assimilated the instruction given them. Also, they were most appreciative of the "painless childbirth" deliveries at the hospital. All abnormal cases were admitted to the hospital for treatment and delivery.

TABLE 1.—*Deliveries from 1 Dec. 1944 to 1 Dec. 1945*

December 1944.....	58
January 1945.....	62
February 1945.....	45
March 1945.....	67
April 1945.....	¹ 25
May 1945.....	30
June 1945.....	55
July 1945.....	55
August 1945.....	63
September 1945.....	59
October 1945.....	137
November 1945.....	182
Total.....	838

¹ Lowest birth rate during the year occurred 9 months after the date of the American invasion.

At the end of the year (1 December 1944 to 1 December 1945), 3,636 prenatal examinations had been made at the various prenatal clinics. The total number of deliveries for the year was 838. Of this total, 319 were delivered during the months of October and November 1945, indicating that the fertility of the Chamorros was markedly increased by improved nutrition, and by proper treatment of worm infestation and of other diseases which had flourished under the Japanese regime. Almost without exception the patients were very anemic, harboring from 1 to 4 types of intestinal parasites. In several instances, patients with hemoglobins of less than 2 grams (10 percent)—effected by hook-worm infestation—were admitted to the hospital for transfusions and vermifuge therapy. For the first time in the history of the island, pregnant women were given helminthagogues. The reluctance of the patients to accept “worm medicine,” in the early days of the clinics, disappeared when they realized that not a single instance of abortion, miscarriage, or premature labor ensued as a consequence of the medication. The midwives delivered 627 patients at home, while 211 patients were delivered in the hospital.

There was but one maternal death for the entire year, an undelivered mother. The patient, a 40-year-old para 14, 34 weeks pregnant, was admitted to the hospital, in shock, due to a toxic placental separation; she was anuric on admission and the clinical picture was not unlike that of a fulminating uremia. Despite seven Rh negative blood transfusions, the patient succumbed. At the end of the year, there were 348 registered undelivered patients.

During the year 43 stillbirths and neonatal deaths were reported for 850 infants. The uncorrected infant death rate was 5 percent.

When macerated fetuses, fetal monsters, and extremely premature infants (under 28 weeks) are excluded, the corrected rate is 2.3 percent. Of the 631 infants delivered at home, there were 23 infant deaths which establishes an uncorrected mortality rate of 3.8 percent. The corrected rate is 2.0 percent (excluding 10 infants). The fetal death rate for 219 infants delivered at the hospital was 9.1 percent (20 infants). The corrected rate is 3.2 percent (excluding 13 infants). Since all abnormal cases were admitted to the hospital for delivery, one would expect a higher infant mortality rate than in the home deliveries where only normal cases were confined. A wooden incubator was constructed by a versatile Seabee and more of the premature infants survived. There is a pressing need for several modern incubators and infant resuscitators at the hospital.

In the course of the clinic work it was observed that very rarely did a patient complain of nausea and vomiting. There were but six cases in all, and these were extremely mild. During the entire year not a single patient was admitted to the hospital for treatment of hyperemesis gravidarum. This experience, undoubtedly, ensues as a consequence of the passive equanimity of the race. The observation becomes more interesting when viewed in comparison with the experience of American women, 50 percent of whom submit to nausea and vomiting. Most obstetricians agree that this complaint, for the most part, is psychic in origin or the result of nervous excitability.

During the year, 104 external versions for breech presentation were performed; thus, the clinical breech incidence of 6.4 percent in the last trimester was reduced to 1.4 percent, at term. Only 12 breech deliveries were done during the entire year. Most of these patients were unregistered and were admitted to the hospital in active labor. Since the delivery of the infant by the breech increases the infant mortality rate, it is felt that the practice of external version is an indispensable procedure.

Seven cesarean sections were performed during the year which establishes an incidence of 0.8 percent, or 1 in every 119 cases. There were no maternal deaths in this group. One Water's extraperitoneal operation was performed in the section series. This patient, a frankly infected para 14, with cephalopelvic disproportion, was admitted to the hospital after 22 hours of labor at home, despite the advice given her in prenatal clinic where the possibility of disproportion was recognized. Both the mother and infant were discharged, well, on the seventeenth postoperative day.

The incidence of pregnancy toxemias was low. Only 17 cases were encountered, or 1 in 49 (2.0 percent). There were 8 mild pre-eclampsics, 8 severe pre-eclampsics, 1 eclamptic. The 1 eclamptic, an unreg-

istered patient, was admitted after several convulsive seizures at home. The infant death rate in this group was 22.2 percent. The corrected rate 11.7 percent. A large majority of the toxemic patients had not registered for prenatal care.

Interestingly enough, only one diabetic patient was seen; she was successfully delivered, through the pelvis, of an active 10½-pound male infant. Her insulin requirement rose from an initial 7 units to 55 units, at term. Skilled assistance from the internists of the Medical Department enhanced the safe deliverance of this patient.

Five cases with mitral stenosis, diagnosed in the prenatal clinics, were admitted to the medical ward for evaluation. All of these cases presented cardiac lesions identical with those of the rheumatic heart patients seen in the States. Adequate bed rest, near term, in the hospital, prevented cardiac accidents and insured safe deliverance of the patients without additional complications.

Seven patients with active or arrested pulmonary tuberculosis were delivered in the hospital. Since the incidence of tuberculosis on the island is high, an unremitting search for the disease was made at the prenatal examinations. Chest plates were taken on all suspicious cases. The ideal program of routine chest plates on all pregnant patients undoubtedly would reveal many early cases of active or incipient tuberculosis. The only therapeutic interruption performed during the entire year was done on a patient found to have active, bilateral pulmonary tuberculosis, with cavitation, at 14 weeks' gestation.

The high morbidity rate in the hospital was most alarming. It is felt that this high rate was attributable to the following factors: (1) The poor resistance of malnourished anemic patients; (2) the high incidence of worm infestation; (3) the incompetence of midwives who allowed patients with complications to remain in labor too long at home before admission; (4) the rapid turn-over of the experienced nursing personnel.

Early in January 1945, 44 midwives were reissued licenses. At that time they were instructed by the obstetrician in charge regarding modern methods of asepsis and the conduct of home deliveries. The midwives were encouraged to attend their respective prenatal clinics. Many of them responded eagerly and much time was spent in modern obstretrical instruction. In May the entire group of midwives attended a school at the hospital conducted by the writer and Lt. (jg) Ruth Davis (NC), U. S. N. R. Miss Davis gave each midwife a mimeographed set of rules regarding the conduct of labor and later held schools for the midwives over the entire island. Excellent results were noted almost immediately in that fewer neglected and infected cases were admitted to the hospital. The approximate one-

third of the midwives who were graduate nurses exhibited a certain amount of competence, while the remaining majority evinced little regard for asepsis.

Excellent highways have been built on the island of Guam and improved transportation facilities should augment hospital deliveries, eventually reducing the practice of midwifery to a minimum. All primiparae and grand multiparae should be hospitalized for delivery, since the infant death rate and maternal complications are greater in these groups. A reeducational obstetrical program has been well established, and, by conscientious perseverance on the part of the hospital staff, the practice of modern obstetrics can be maintained with the gratifying result of a very low maternal and infant death rate. The Navy has been requested to send a qualified obstetrician to the island of Guam so that safe deliverance of the Chamorros may be assured in the future.

STATISTICAL REPORT

[1 Dec. 1944 to 1 Dec. 1945]

Total number of deliveries, miscarriages, and abortions.....	885
Total number of undelivered registered patients 1 December 1945.....	348
Total for the year.....	1,233
Total number of prenatal examinations during the year.....	3,636
Number of home deliveries.....	627
Number of hospital deliveries.....	211
Total number of deliveries.....	838
Number of infants delivered at home (includes 4 sets of twins).....	631
Number of infants delivered in the hospital (includes 8 sets of twins)....	219
Total number of infants delivered (including 12 sets of twins)....	850
Maternal mortality rate (delivered patients).....percent..	0.0
Maternal mortality rate (including one patient who died undelivered— toxic placental separation).....percent..	0.1
Number of infant deaths.....	43
Infant mortality rate (uncorrected for 850 infants).....percent..	5.0
Corrected infant mortality rate (excluding 23 infants).....percent..	2.3
Number of infant deaths (home deliveries).....	23
Uncorrected infant mortality rate (home deliveries).....percent..	3.8
Corrected rate for home deliveries.....percent..	2.0
Number of infant deaths (hospital deliveries).....	20
Uncorrected fetal mortality rate (hospital deliveries).....percent..	9.1
Corrected rate for hospital deliveries.....percent..	3.2
Maternal morbidity rate (hospital deliveries).....percent..	22.7

*Hospital morbidity rate per month*¹

	<i>Percent</i>
December 1944.....	20.0
January 1945.....	9.0
February 1945.....	11.0
March 1945.....	28.5
April 1945.....	20.0
May 1945.....	21.4
June 1945.....	18.7
July 1945.....	26.3
August 1945.....	24.2
September 1945.....	20.0
October 1945.....	17.2
November 1945.....	29.0

¹ The morbidity rate should not exceed 3 to 4 percent.

Hospital deliveries

Normal deliveries (this includes many patients who had poor obstetrical histories and medical complications).....	102 (48.4%)
Operative deliveries.....	109 (51.6%)
Operative deliveries excluding 10 breech extractions and 7 cesarean sections.....	42.1%
Primiparae.....	70 (33.1%)
Multiparae.....	141 (66.9%)
Number of patients 40 years old and over.....	14 (6.0%)
Obstetrical analgesia (nembutal and scopolomine).....	166
Obstetrical anesthesia:	
Spinal (novocaine 70 mg.).....	74
Ether (open drop).....	57
Episiotomies:	
Median.....	58
Mediolateral.....	6
Lacerations:	
First degree.....	9
Second degree.....	5
Third degree.....	0

Miscellaneous

Pregnancy toxemias:	
Mild pre-eclampsia.....	8
Severe pre-eclampsia.....	8
Eclampsia.....	1

Total number of toxemic patients.....	17
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Incidence of toxemias 1 in 49 patients (this includes all the deliveries for the year).....percent	2.0
Number of infants delivered from the toxemic group (this includes 1 set of twins).....	18
Number of infants dead (from toxemic patients).....	4 (22.2%)
Toxic placental separation.....	2

Cardiacs (mitral stenosis)	5
Pulmonary tuberculosis	7
Diabetes mellitus	1
Pyelitis of pregnancy	3
Hydatid mole (curettings on a 43-year-old para 14, 11 weeks pregnant, revealed malignant degeneration—chorio-epithelioma— a panhysterectomy was performed)	2
Number of patients delivered via the pelvic route following previous cesarean sections for temporary indications	5
Number of abortions and miscarriages treated in the hospital	46
Length of labor :	
Primiparae	hours__ 12. 1
Multiparae	hours__ 6. 9
Average weight of infants	7 lb. 2 oz.
Cesarean operations (1 in every 119 cases 0.8 percent)	7
Maternal mortality rate (cesarean sections)	percent__ 0. 0
Infant mortality rate (cesarean sections)	percent__ 14. 2
Corrected infant death rate (excluding 1 infant dead on admission—toxic placental separation)	percent__ 0. 0

NOTES ON CESAREAN SECTIONS

1. *Marginal placenta previa.*—28-year-old para 2. Oblique breech presentation. Transverse presentation at 7½ months' gestation. Soft tissue film at that time revealed a low posterior wall implantation suggestive of a marginal or partial placenta previa. There was no vaginal bleeding prior to the sterile vaginal examination under "double set-up" precaution. Kroenig section under ether anesthesia. 8 lb. 6 oz. female infant.

2. *Cervical dystocia.*—42-year-old primipara. 12-hour test of labor. Kroenig section under local (novocaine) and pentothal anesthesia. 7-lb. male infant.

3. *Cephalopelvic disproportion.*—44-year-old para 14. Flat pelvis—(promontory reached at 10¾ cm.). Ruptured membranes for 26 hours and 22 hours of labor at home. Temperature 101.4° F. Water's extraperitoneal section under spinal (novocaine 125 mg.) anesthesia. 8 lb. 8 oz. female infant.

4. *Cervical dystocia.*—37-year-old primipara (sterility for 9 years). 12 hours test of labor. Flat pelvis (promontory felt at 11½) with a slight funnel tendency. Kroenig section under local and pentothal sodium anesthesia. 7 lb. 1½ oz. female infant.

5. *Toxic placental separation (complete).*—Unregistered 22-year-old primipara, 8 months' gestation. Concealed internal hemorrhage—infant dead on admission. "Double set-up" examination revealed a long rigid cervix. Albumin 3 plus. Beginning anuria. Low classical caesarean section under pentothal sodium anesthesia. Slightly macerated 6 lb. 8 oz. male infant.

6. *Fetal distress*.—Occult prolapse of the cord. 39-year-old primipara (19 years of sterility). Labor 4½ hours. Kroenig section under pentothal anesthesia. 7 lb. 8 oz. female infant.

7. *Complete placenta previa*.—Unregistered 33-year-old para 2. 35 weeks' gestation. "Double set-up" examination. Low classic section under pentothal anesthesia. 5 lb. female infant.

Patients registered—(undelivered)

1 December 1945 (11 prenatal clinics)	348
Primiparae	57 (16.3%)
Multiparae	291 (83.7%)
Average age	28.5 years
Average parity	4.8
Number of illegitimate pregnancies	21 (4.3%)
Incidence of breech presentations in 348 undelivered patients	26 (7.4%)
Positive blood Kahns (early and latent yaws)	31 (8.9%)
Percentage of positive stools for amebiasis, ova of hookworm, and ascaris lumbricoides	73.5%

Cause of infant deaths

Stillbirths and neonatal deaths	16
Macerated fetuses	10
Prematurity (under 32 weeks)	10
Congenital anomalies	3
Icterus gravis (erythroblastosis fetalis)	2
Prolonged second stage	2
Total number of infant deaths	43

INTERPRETATION OF INFANT DEATHS

Hospital deliveries

1. *December 1944, intra-uterine pneumonia*.—Infant died in 14 hours; unregistered 29-year-old para 1. Ruptured membranes for 26 hours, labor 22 hours at home. Easy frank breech extraction. Autopsy.

2. *January 1945, prolapsed cord and arm—transverse presentation*.—Dead on admission. Version and extraction—42-year-old para 8. Labor 8 hours at home. Brought in by midwife after the cord prolapsed. No autopsy.

3. *February 1945, prolapsed cord and arm*.—42-year-old para 13. Transverse presentation, labor 12½ hours. Accident occurred in the hospital when the cervix was fully dilated. Bandl's contraction ring. No autopsy.

4. *March 1945, congenital heart-disease*.—Patent ductus arteriosus. Infant lived 2 days. 30-year-old primipara. 10-hour labor. Primiparous low forceps delivery. Autopsy.

5. *April 1945, Twin No. 1—prematurity 35 weeks*.—Normal breech delivery. Weight approximately 3 lb. 12 oz. Infant lived 36 hours. 25-year-old para 2. No autopsy.

6. *April 1945, Prolonged second stage (8 hr.) stillborn female infant*.—25-year-old para 1. Labor 18 hours. No analgesia or anesthesia. Infant weighed about 7 lb. No autopsy.

7. *April 1945, macerated term infant*.—Intra-uterine asphyxia of about 3 days' duration. (Dead on admission.) 25-year-old para 1. Labor 12 hours. Primiparous low forceps. No autopsy.

8. *May 1945, stillborn infant.*—Unregistered 40-year-old para 1. Labor 11 hours at home. Severe pre-eclampsia. Blood pressure 196/30, albumin 4 plus, edema 3 plus, anuria. Membranes ruptured at full dilation with the head engaged—meconium stained fluid escaped. Difficult mid-forceps. L. O. T. position. Term male infant, 8 lbs. Autopsy showed cerebral hemorrhage.

9. *June 1945, stillborn infant (cord tightly about neck).*—31-year-old para 1. Labor 14 hours. Good fetal heart before draping. Easy low forceps. Autopsy negative.

10. *June 1945, hemorrhagic disease of the newborn. (Erythroblastosis fetalis—icterus gravis).*—36 weeks. 4 lb. 8 oz. female. Infant lived 2 days. 35-year-old para 12. Essential hypertension with superimposed severe pre-eclampsia. Labor induced by artificial rupture of the membranes. 5-hour labor. Normal delivery. Autopsy.

11. *July 1945, prematurity, 28 weeks.*—Infant weighed 3 lb., lived 3 hours. Premature rupture of the membranes. 24-year-old para 2. Labor 3 hours. L. O. A. position. No autopsy.

12. *August 1945, prematurity 30–32 weeks.*—Weight 2 lb., lived 3 hours. Mother was in the hospital because of acute pyelitis. 23-year-old para 4. Breech presentation. No autopsy.

13. *August 1945, macerated postmature female infant (43 weeks. Dead on admission).*—Intra-uterine asphyxia of 3 to 4 days' duration. 30-year-old primipara 9-hour labor. L. O. A. position. Infant weighed 8 lb. 10 oz. No autopsy.

14. *August 1945, prematurity, macerated fetus.*—32 weeks, female infant. Weight 3 lb. 12 oz. Premature labor. 25-year-old para 2. Multiparous normal delivery. 3-hour labor. No autopsy.

15. *September 1945, macerated fetus.*—Nontoxic placental separation. 25-year-old para 9. Infant dead on admission. (30 weeks.) No autopsy.

16. *September 1945, cord about neck.*—Loop of cord in forcep blade. 23-year-old para 1. Labor 8½ hours. (This patient had a red blood count of 240,000 and the hemoglobin was less than 2 grams at 5½ months' gestation.) Cord blood taken—blood count was not reported. Autopsy negative.

17. *September 1945, toxic placental separation.*—Dead on admission. Unregistered 22-year-old para 1. 8 months' gestation. (Classical section because of a long rigid cervix.) No autopsy.

18. *October 1945, prematurity—macerated fetus.*—32 weeks, weight 4 lb. 3 oz. 37-year-old para 8. Severe pre-eclampsia, deformed infant. No right forearm. No autopsy.

19. *November 1945, anencephalic monster.*—Unregistered 29-year-old para 8. Version and extraction. Term infant weighing 7 lb. No autopsy.

20. *November 1945, macerated fetus (36 weeks).*—Prolapsed cord and arm. Dead on admission. Unregistered para 2. (This patient, as a primipara, experienced the same accident.) No autopsy.

INFANT DEATHS

[Home deliveries (since many of the patients were unregistered, very little data were available)]

1. *M. S. A.*—(12–4–44) lived 10 days. Icterus neonatorum—(died in hospital)—no autopsy.

2. *A. T.*—(1–1–45). Stillborn—no autopsy.

3. *I. A. C.*—(1–19–45) Stillborn—no autopsy.

4. *M. C. S.*—(Feb. 1945). Macerated fetus—no autopsy.

5. *R. C. T.*—(8-25-45). Prematurity—lived 14 hours—no autopsy.
6. *T. S. D. M.*—(8-27-45). Stillborn—male. No autopsy.
7. *A. N. A.*—(8-16-45). Lived 7 days. Died in hospital. Autopsy showed "Kern Icterus". (Erythroblastosis fetalis-Icterus gravis)
8. *M. P. P.*—(8-10-45). Lived 1 hour. Autopsy revealed a pulmonary hemorrhage—ruptured pulmonary artery. Normal delivery.
9. *A. M. V.*—(July 1945). Stillborn male—7 months. No autopsy.
10. *M. H. Q. C.*—(7-5-45). Lived 5 days. Prematurity 35 weeks. Icterus neonatorum. No autopsy.
11. *R. L. Q. de L. G.*—(5-23-45). Stillborn—no autopsy.
12. *E. E. S.*—(4-24-45). Prematurity—stillborn. No autopsy.
13. *I. B.*—(4-25-45). Stillborn male—prematurity. No autopsy.
14. *A. M. T.*—(11-20-45). Stillborn male—precipitate delivery—no midwife (patient was booked for a hospital delivery). Autopsy showed cerebral hemorrhage.
15. *M. M. Q.*—(11-5-45). Stillborn—prematurity. No autopsy.
16. *M. T. P.*—(10-23-45). Premature stillborn—(30 weeks)—no autopsy.
17. *L. G. T.*—(10-16-45). Lived 7 hours. Autopsy showed cerebral hemorrhage. Male infant.
18. *J. S. M. Q.*—(10-15-45) Stillborn female—8 months. Autopsy showed cerebral hemorrhage and atelectasis.
19. *A. M. S.*—(10-12-45). Macerated fetus—female. No autopsy.
20. *A. M. G.*—(11-10-45). Lived 5 minutes. Autopsy showed atelectasis and hydronephrosis.
21. *V. R. A.*—(9-13-45). Stillborn male—premature separation of the placenta (nontoxic). No autopsy.
22. *M. M. S.*—(9-9-45). Stillborn macerated male. No autopsy.
23. *J. S. C.*—(9-10-45). Lived 2 days—convulsions. Autopsy showed cerebral hemorrhage.



A REVIEW OF THE PHYSIOLOGY OF BLOOD COAGULATION AND ITS RELATIONSHIP TO SOME OF THE COMMON HEMORRHAGIC DISORDERS

With Report of a Case of Unexplained Purpura

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Abnormalities in blood coagulation are not at all uncommon and are seen virtually in all phases or specialties of medical practice. Many of these disease entities are well understood and their treatment and prognosis accordingly can be outlined with a reasonable feeling of security on the part of the attending physician. There are, however, many times when the doctor's imagination is taxed, when he is faced with hemorrhagic problems that differ from the usual textbook case and that are a source of considerable concern to himself, to say nothing of the patient's interest in the disease.

During the past year at the U. S. Naval Hospital, Naval Medical Center, Guam, several very perplexing problems along this line have appeared. Space does not permit reviewing each case individually. The one case to be presented appeared grossly similar to many of the others and differed only in that it unexpectedly terminated fatally.

PHYSIOLOGY

Theories on the coagulation of blood are many and varied. Howell's theory, upon which numerous modifications have been suggested, forms an excellent working basis. In substance (fig. 1) the clotting of blood rests upon the interaction of formed elements in the blood, catalysts and an ionic chemical. Antiprothrombin and prothrombin are held in combination in the circulating blood. Damage to the endothelium and contact with the tissue juices allows the existing thromboplastin (which is outside of the circulating media) to combine with the antiprothrombin thereby releasing the prothrombin fraction which in turn combines with the ionized calcium in the blood. The end product of this reaction is thrombin. Thrombin reacts with the protein fibrinogen to make the fibrin network. This network then snares the various cellular elements (red and white blood corpuscles) and the platelets. Because of the platelets present in the network the clot retracts and bleeding ceases.

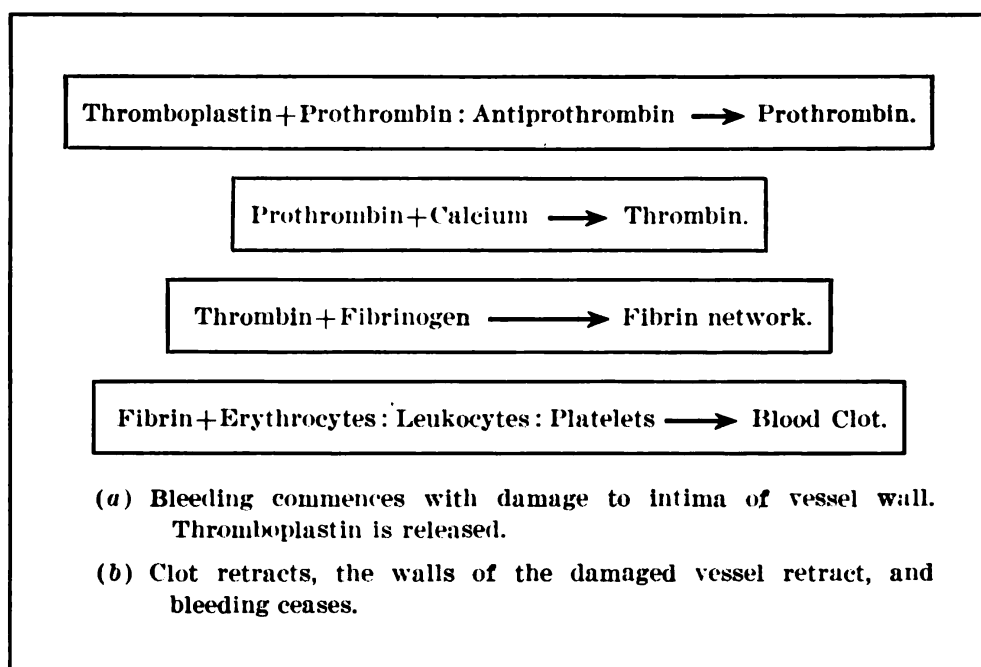


FIGURE 1.—Diagrammatic representation of the physiology of blood coagulation.

From the several steps involved in the reaction it is clearly seen that any serious deficiency or chemical or structural abnormality of any part will upset the entire equation resulting in prolonged bleeding. Fortunately nature has provided man with sufficient excesses of the essential elements so that a marked reduction or deficiency is necessary before abnormal bleeding occurs. In verification of this we know that bleeding tendencies due to a prothrombin deficiency must have a value not greater than 20 percent of normal for that particular fraction; that there is no known condition wherein the calcium level of the blood is so low that coagulation will not occur; and that it is exceedingly rare to find the plasma fibrinogen level so low as to cause spontaneous or prolonged bleeding.

To determine in a given case what elements or group of elements is involved several standard laboratory tests have been devised. Quantitative or qualitative determinations of these fractions gives us a clue to solving the problem.

The clotting time with a normal value of from 3 to 15 minutes utilizes the factors noted in figure 1, with the exception of the clot retraction phenomenon. The bleeding time with a normal value of from 1 to 3 minutes depends on the interaction of all factors noted in figure 1, plus the additional factor of elasticity of the vessel wall. The prothrombin time is an indirect measure of the prothrombin content of blood and is customarily expressed in terms of percent of normal. These three tests plus the additional Rumpel-Leede capillary

permeability test and the clot retraction phenomenon give one a fair insight into the bleeding problems. For technical details covering these tests one may consult any of the standard laboratory manuals.

CONGENITAL HEMORRHAGE DISORDERS

In the light of what has been set forth above a clearer insight into the pathogenesis of the various hemorrhagic states is obtained. Among the more frequently seen congenital hemorrhagic disorders we have (*a*) thrombocytopenic purpura, (*b*) hemophilia, (*c*) pseudohemophilia, and (*d*) hereditary hemorrhagic telangiectasia.

Thrombocytopenic purpura

In this disease the blood clots normally (normal coagulation time) but the bleeding continues (prolonged bleeding time). This latter phenomenon is due to a deficiency in two factors: First, there is a deficiency in the number of platelets and the clot fails to retract; second, the normal vascular elasticity is not present (*1*) to approximate the edges of the severed vessel. Thrombocytopenic purpura is marked by the appearance of acute or chronic hemorrhages from the mucous membranes and by the appearance of purpuric areas in the skin. Remissions are to be expected. It is seen most frequently in young females. Of the various forms of therapy tried, splenectomy offers the most. The procedure will cure about 70 percent of the cases and is based on the knowledge that the spleen normally removes platelets from the circulation. With an already existing deficiency in their number the removal of the spleen will lessen the rate of their destruction and correspondingly lessen the bleeding tendency. Splenectomy, of course, does not alter the contractility of the vessel wall so approximately 30 percent of the cases will continue to show symptoms seen prior to operation.

Hemophilia

"The disease of kings" is a congenital bleeding state in which there is a failure on the part of the blood platelets to release thromboplastin. The platelets in this case are excessively stable and do not break down readily. The thromboplastin in the tissue juice is functional but allows for clotting only at the periphery of the wound. One finds in hemophilia a normal bleeding time but a prolonged clotting time. This is diagnostic. No known therapy exists other than repeated transfusion when necessary. Fortunately this disease is uncommon. It is a sex-linked characteristic transmitted by the female carrier to the male offspring. Theoretically it is possible to have a female hemophiliac, but this would involve a double defect within the product of conception which render itself inviable.

Pseudohemophilia

In contrast to hemophilia, pseudohemophilia is seen more often in the female. There is found a low platelet count (below 100,000 per cu. mm. of blood) and those platelets that are present are often large and granular. This disease is considered by some to be the result of an allergic phenomenon, though Quick (1) feels it is a congenital malformation of the platelets. The pathologic picture is one of a megakaryocyte deficiency within the bone marrow. There is a prolonged bleeding time as to be expected with a low platelet count, and the tourniquet test is positive.

Hereditary Hemorrhagic Telangiectasia

The diagnosis of Rendu-Osler-Weber disease is becoming increasingly more common. It deserves mention only because of the clinical picture of frequent episodes of epistaxis with associated bleeding from the membranes of the gastro-intestinal tract. The defect is anatomical and not physiological, there being numerous telangiectatic areas disseminated throughout the body.

The allergic manifestations of bleeding abnormalities are seen most often in the (a) Henoch-Schönlein purpuras and (b) rheumatic fever.

Henoch-Schönlein purpura

This is a syndrome in which bleeding occurs from the mucous membranes of the gastro-intestinal and genito-urinary tracts, the synovial layers of the joints, and into the subcutaneous tissues. The offending allergen, if removed, will bring about a clinical cure (2).

Rheumatic fever

This common clinical picture still presents an obscure etiology though the weight of evidence lies heavily on the side of an allergy to specific bacterial (*streptococcus hemolyticus*) products. Purpuras with rheumatic fever are not uncommon during the acute and active phase of the illness. As the disease subsides into a quiescent or arrested phase the evidence of spontaneous bleeding disappears. One must be on the alert here not to confuse the purpura due to rheumatic fever itself with the purpura resulting from the therapy of rheumatic fever. With the present-day use of maximum doses of sodium salicylate and drug allergy should be kept in mind.

Waterhouse (3) in 1911 and Friderichsen (4) in 1918 described several cases of suprarenal apoplexy. This is characterized by pyrexia, shock, nausea, vomiting, diffuse purpura, and adrenal hemorrhage. In their descriptions they found the etiology to be obscure as postmortem cultures were for the most part sterile or inconclusive. It is now known that the meningococcus was the offending organism. The

treatment of the Waterhouse-Friderichsen syndrome depends on prompt and adequate use of the sulfonamides and penicillin supplemented with parenteral adrenal cortical extract. Septicemias by other organisms may produce a similar picture but occur much less frequently. The reason for the purpura is obscure, but is likely due either to a direct toxic action on the capillaries increasing their permeability, or to an indirect but similar result from toxic action on the liver.

Virtually all known drugs may at one time or another exert toxic effects on the red and white blood corpuscles and their genetic precursors within the narrow cavities. The results are varied but hemorrhagic tendencies do appear. Among the common therapeutic agents in which this particular form of toxicity is seen are sulfonamides, ether, benzene, thio-urea, and thio-uracil, salicylates, gold, alcohol, colchicine, quinine, and recently Freud and Greenberg (5) reported a case due to pertussis vaccine. The management of drug purpuras obviously is the withdrawal of the offending agent and supportive therapy.

This brings us into the subject of constitutional diseases in which bleeding tendencies are seen. Commonly liver diseases rate first place. The liver, having as one of its functions the production of prothrombin and as another detoxifying systemic poisons, is caught between the cross-fire of two opposing forces, one productive and the other destructive. With a predominance of toxins or infectious agents the productive function may lag, sufficient prothrombin then is not formed to maintain normal blood coagulation. Added to this is a failure to utilize vitamin K (2-methyl-1,4 naphthoquinone). Acute hepatitis notoriously produces abnormal bleeding tendencies. This is the result of a failure on the part of the liver to produce sufficient prothrombin, which is further due to a failure to utilize vitamin K. The treatment for the hemorrhagic phase of this disease is to administer vitamin K, whole blood, and plasma. Certain protein fractions (6) of plasma and specific amino acids are indicated as therapeutic aids.

It is not uncommon to see, in a case of early cirrhosis, hematuria as the only positive finding. This is again attributable to the extensive involvement of the organ with inadequate prothrombin production. To this may be added a long list including scurvy, malaria, scarlet fever, Banti's syndrome, leukemia, biliary fistula, and biliary obstruction. The defect in scurvy is another example of increased capillary permeability, the result of deficient vitamin C (ascorbic acid) absorption or ingestion, and accordingly inadequate formation of the intercellular cement substance in the capillary walls. In malaria and scarlet fever the causative organism exerts a toxic action on the capillary

walls allowing blood to leak into the adjacent tissues. Banti's syndrome as would be expected has the same physiopathological basis as the hepatic dysfunctions noted previously.

Bile is necessary for the absorption of vitamin K. When an inadequate amount of bile is present in the small intestines an avitaminosis K appears and the production of prothrombin is correspondingly diminished. Hemorrhagic phenomena then appear. Such is the case with biliary fistula and obstruction.

Hemorrhages in the leukemias (11) result from the extensive infiltration of the marrow cavities and tissues by the pathological cells, destroying all normal hematopoiesis and disrupting the entire physiological process of blood coagulation.

One should not leave the discussion without brief mention of the agents designed to prolong bleeding. As is well known oxalates and citrates are used to prevent blood from coagulating in vitro. The action is simple—the citrates and oxalates combine with the ionized calcium preventing the formation of thrombin from prothrombin. Heparin will prolong the coagulation or clotting time of blood by inhibiting the action of thromboplastin. Heparin is used therapeutically in coronary thrombosis, phlebothrombosis, and thrombophlebitis. It has quick action and will prolong the clotting time of the blood within 1 hour following its administration, from its normal value of 3 to 15 minutes, up to 30 to 60 minutes. It is given by the continuous intravenous route in doses of 150 milligrams, or in individual doses repeated in 3 or 4 hours with as much as necessary. Repeated clotting-time determinations should be made. Heparin can also be given subcutaneously in a similar dosage but at less frequent intervals, every 2 to 3 days (6), if mixed with a specific base consisting of gelatin, dextrose, glacial acetic acid, and water. This mixture, known as heparin/Pitkin (7), is used in getting prolongation of the clotting time pending the onset of action of dicoumarol.

3,3' methylenbis (4-hydroxycoumarin), commonly known as dicoumarol, was isolated by Link and his coworkers in 1941 at the University of Wisconsin. This substance, found originally in spoiled sweetclover hay and later synthesized, has the property of prolonging the prothrombin time of the blood by inhibiting the formation of prothrombin by the liver. Administered in doses of 300 mg. the first day and followed by 100 mg. daily, its action appears in from 3 to 5 days. This is in contrast to the rapid action of heparin. According to Zucker (10) and many other investigators the prothrombin time under dicoumarol therapy should be kept within a range of 60 percent to 30 percent of normal. It should never be allowed to drop below 20 percent of normal. The combined use of heparin and dicoumarol promises to be the answer to treating arterial and venous occlusions and as a prophylaxis against the formation of pulmonary or systemic emboli. Because of the wide

variety of individual responses to dicoumarol, daily prothrombin time determinations are absolutely indicated.

Should spontaneous hemorrhages appear or be suspected following the use of either heparin or dicoumarol, therapy should be discontinued immediately. With heparin poisoning protamine may be given to neutralize the excess and vasoconstrictors and pressure or cold applications may be used over the site of the injection. Whole blood transfusions should be given. In the event of dicoumarol poisoning it is likewise vital to see to the administration of frequent transfusions. There appears to be conflicting opinion regarding the effectiveness of vitamin K in restoring a normal prothrombin time following dicoumarolization. Peters (8) states that in coronary thrombosis vitamin K is efficacious should the prothrombin time drop to dangerous levels. Bauerlein (9) takes the opposite view. Further investigation in this direction is certainly warranted, although it is felt large doses of vitamin K are effective.

CASE REPORT

J. D. H., a 22-year-old seaman first class, was seen at an outlying dispensary on 23 May 1946 complaining of nausea, vomiting and headache of a few hours' duration. This was followed by generalized abdominal pain and diarrhea. No hematemesis or melena had been noted. The physical examination was entirely normal at that time. He was placed in bed and observed. Two days later many hemorrhagic areas were noted on the right upper and lower extremities and in both eye grounds. Cervical rigidity with exaggeration of the reflexes on the right was elicited. He was transferred to the U. S. Naval Hospital, Guam, on 25 May 1946. On admission here he appeared entirely alert and his history was confirmed. There was no history of recent trauma, ingestion or inhalation of any noxious substance. His family history of bleeding tendencies was negative. Physical examination revealed a diffuse purpura. His temperature was 100° F.; pulse rate, 90; and respiratory rate, 20. There was an unequivocal cervical rigidity and hemorrhages were noted in both eyes. Because of an admission from the same area on the island of a case of meningococcal meningitis 2 days previously, a spinal tap was performed. On entering the third lumbar space what appeared grossly to be arterial blood spurting from the needle was encountered. Some of the blood was collected and with a clean needle entry was made into the spinal canal in the fourth lumbar space. Again blood was found to spurt synchronously with the pulse. A small sample was sent with the original specimen to the laboratory, neither having clotted in a period of approximately 20 minutes. Both specimens revealed approximately 240,000 red blood corpuscles per cu. mm., and 1,150 white corpuscles per cu. mm., with a differential of 56 percent segmented leukocytes and 40 percent lymphocytes. The peripheral blood picture showed 3,850,000 red blood corpuscles per cu. mm., and 9,500 white corpuscles per cu. mm. The differential analysis was reported as 42 percent segmented neutrophils, 58 percent beta lymphocytes, 1 basophile and 2 monocytes. The platelet count was 198,000 per cu. mm., of blood. The bleeding time was 1 minute 5 seconds, and the clotting time was 5 minutes 30 seconds. Two hours after admission the patient lost consciousness. His blood pressure rose to 240/120 and his pulse to 130 per minute. He failed to respond to coramine, caffeine, or oxygen and expired 8 hours after admission.

The pertinent postmortem findings were extensive superficial and meningeal hemorrhages, congestion and hemorrhage in the viscera, and the presence of a cerebellar pressure cone. Within the myocardium were small collections of cells which though not staining clearly resembled immature leukocytes. Due to technical difficulties bone marrow section were not obtained.

This case, though incomplete in the final analysis, presents several vital points. The spinal puncture possibly precipitated his death, though it was considered a justifiable procedure in view of the recent case of meningitis admitted to the contagious service. The finding of abnormal leukocytes in the myocardium strongly suggests an acute aleukemic leukemia, though the other tissues were reported normal. Except that this case ran its course rapidly and terminated fatally, it was at the onset similar to several others seen. The question of establishing an etiology is difficult. It is hoped that future cases will clarify this.

SUMMARY

1. The physiology of blood coagulation is reviewed and represented diagrammatically, and the pathology, diagnosis, and treatment of some of the common bleeding states are discussed.
2. Dicoumarol and heparin therapy is outlined with emphasis on the necessity for repeated prothrombin time and clotting time determinations.
3. A case of purpura of unexplained etiology is presented, noting some of the pitfalls in attempting to establish an etiological agent.

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THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION OF
THE PHYSICIAN.—Hippocrates

EDITORIALS



50th ANNIVERSARY OF THE ESTABLISHMENT OF THE HOSPITAL CORPS

The fiftieth anniversary of the establishment of the Hospital Corps of the Navy will be 17 June 1948 and the Hospital Corps Quarterly is planning to make the April-May-June number a special anniversary issue. It is hoped that this will include a special cover, a résumé of the history of the Hospital Corps, and highlights of its activities during the 50 years of its existence. The reminiscences of early members and of prominent Hospital Corps officers will be included. There is a great amount of illustrative material and it is intended to have pictures of events and people connected with the Hospital Corps from its foundation to the present day.

If anyone who receives the United States Naval Medical Bulletin or other interested individuals or organizations has any information, pictures, anecdotes, or other material which it is thought might be suitable for this anniversary number it would be appreciated if they would send it to the editor of the Hospital Corps Quarterly for consideration for use in this anniversary number.



CERTAIN STATISTICAL AND SOCIAL ASPECTS OF DIABETES

In the eighth edition of the book, "The Treatment of Diabetes," Dr. Joslin draws attention to a number of most interesting statistics and general information regarding diabetes and diabetics. Some of these are probably widely known but with others neither laymen nor medical men are too well acquainted.

The number of diabetics in the United States is estimated at about one million, though there are great difficulties in making a diabetic census and there have been considerable differences in the estimates. It is doubtful if there has been any real increase in incidence, but that this large population is due to the great diminution in the death from diabetes following the discovery of insulin. It is estimated that insulin has increased the life span of the diabetic by an average of about 20 years, and it is this circumstance that has caused the increase in the number of living diabetics. Before the discovery of insulin, many of these cases would not have lived. Another fact of importance, of course, is the increased accuracy of diagnosis and reporting of cases.

Diabetes is more common in women and in older age groups. It is also greater among the Jewish race and among the obese. It is more frequent in married women. It was found in identical twins in nearly 50 percent of the cases seen by Dr. Priscilla White (33 cases) and only 3.5 percent among dissimilar twins (63 cases). It would appear from this and some other reasons that there is an inheritance of some gene that is present in diabetic strains that causes perhaps a hyperactivity of the pituitary that in turn acts on the pancreas.

A review of some of the features of diabetes reveals that:

- (1) Diabetes is universal and found in all races.
- (2) The number of diabetics in the United States has increased largely because the use of insulin has prolonged the life of the diabetic individual.
- (3) It is more frequent among the obese and those living on a liberal diet.
- (4) The incidence is greater among the Jewish race.
- (5) It is greater among women than among men.
- (6) It is greater among married women.
- (7) There is a higher rate in cities.
- (8) It is greater among those with leisure.
- (9) Mortality for diabetics is increased apparently by indulgence in liquor.

A striking evidence of the effect of the increase in diabetes with increased nutrition is shown by the comparison of the rate among the Irish in Ireland and Americans of Irish descent. The diabetic rate in the former is low, in the latter far higher than in Ireland. This is ascribed to the higher level of prosperity here.

Another interesting fact brought out by Joslin is that the nervous element and also trauma, both of which have been long considered as etiological factors, are largely discredited as causes of the disease.



THE PHYSIOLOGICAL CLOCK

It is a matter of common experience to most people that the human body runs on a chronological basis. We all know the periodic return of hunger around the regular mealtime. The infant will tell its feeding time almost to the minute. It is an interesting fact that habits of awakening in the morning becomes so fixed that an alarm clock is not more accurate than the body itself in arousing one from sleep. Habits of elimination are formed by both the bowel and bladder, and it is probable that secretory activities are affected by time patterns. Mental associations have a definite relation to certain times of the day and while other stimuli cannot be completely ruled out, periodicity certainly plays a part.

It is obvious that changes in the mode of life in the usual regular time of doing any routine thing throws a physiological strain on the organism. Travel involving moving from one time zone to another, shifts of the clock in the so-called daylight saving plans, changes in mode of life, such as from day to night shifts, or other alterations in working hours result in considerable biological stress. In the young and vigorous these are not so important, though the cumulative effects here may be felt. For the old, the feeble, the infant, and the sick, the results are no doubt sometimes harmful to a serious degree.



ONE AND ONE-HALF MILLION BIRTHS IN THE UNITED STATES IN THE FIRST FIVE MONTHS OF 1947

Busy obstetricians and out-patient departments will be interested in the figures on the birth rates in the United States released by the National Office of Vital Statistics, United States Public Health Service.

Births in May are estimated to have numbered 302,000 in the United States. This is 29 percent more than the estimate for May of last year and it brings the total for the first 5 months of 1947 to 1,572,000.

Although the birth rate of 26.4 per 1,000 population, including the armed forces overseas, for the 5-month period January to May 1947, was nearly 40 percent higher than the provisional rate of 19.1 for the

corresponding period of 1946, the birth rate has been lower this year than it was in the last 4 months of 1946 when it reached record-breaking heights. The decrease has taken place in spite of the fact that statistics show that the numbers of marriages reported 10 to 12 months ago and throughout 1946 were unusually large. It is possible that the peak in the birth rate in the latter months of 1946 was due not only to first births to newly married couples, but also to births to families who already had children and first births to couples married before or during the war. The fact that the birth rate has decreased while marriages remained high suggests that now second and third births to established families and first births to persons married more than 1 year are adding less to the birth rate than they did at the end of last year.



COMPULSORY EXERCISE IN RELATION TO HEALTH

Medical supervision of physical exercise is one of the cults of the Anglo-Saxon, and there is an old English saying in praise of horseback riding as healthful recreation, "That the outside of a horse is good for the inside of a man." It would not be true, however, if the man had either gallstones or a hernia, or a number of other pathological conditions—a furuncle on the buttocks, for example. The fact of the matter is that there is too great an endorsement of exercise as a health-giving measure without proper attention to the condition of the person for which it is recommended. This is a particularly dangerous tendency because of the compulsory use of exercise not only in military forces but in our public schools.

Physical exercise in moderation, suited to the age, sex, and state of health of the individual, favorably affects the vasomotor system and the voluntary muscles, improves metabolism and sleep, and increases the strength of voluntary muscles as well as having a number of other physiological effects, some of which are not clearly understood, though most of them appear to be favorable. Age has a definite bearing and young animals in captivity seem to maintain health and physical efficiency with relatively little exercise.

Excluding injuries received in athletics, damage can be done by poorly supervised compulsory physical exercise given to large groups. This is more the case in schools than in military organizations. In the

latter only young men (and now young women) who have been screened by a physical examination are subjected to regimented exercise. Medical observation of military personnel is usually continuous and rigid. In schools where such supervision is often lacking, the child just coming down with an acute infection such as diphtheria or meningitis, or other serious acute conditions, may have their resistance lowered by physical exertion at this time to such a degree that what might have been a mere subclinical immunizing infection may be converted into a severe case of the disease leading to death or crippling effects.

In older people exercise must also be very selective. Coronary disease, hypertension, and many other conditions become more frequent and caution as to the extent and kind of exercise is necessary.

Another consideration is the fact that the physiological machine is of varying efficiency, not only differing in each individual, but changing in the same individual from hour to hour, as well as losing efficiency through deterioration. Day by day physiological efficiency is affected by numerous factors such as fatigue, gastro-intestinal disturbances, subclinical infections, loss of sleep, alcohol, emotional upsets, and many others.

It is thus seen that physical exercise is not a matter to be dealt with lightly if the real object is to improve the state of health and physical efficiency. The age, sex, and physical condition must be a matter of careful and serious concern, particularly where group compulsory physical exercises are used. Not only is medical supervision essential but medical men need to study this problem with care and be prepared to make recommendations which are based on sound facts and common sense.



QUESTIONNAIRE ON THE NAVAL MEDICAL BULLETIN

It is hoped that as many of our readers as possible will answer the questions on the page at the end of this editorial section. Cut out the page along the ruled edge and mail to the Editor of the BULLETIN.

The UNITED STATES NAVAL MEDICAL BULLETIN now has one of the widest distributions of any medical journal in the United States. In addition to the Officers of the Medical Department of the Regular Navy, it goes to Reserve Medical and Dental Officers, to most medical libraries and medical schools in this country, and by exchange with for-

eign medical journals to many other countries. It is extensively quoted and abstracted, and has the largest circulation of any publication in naval medicine. The nearest to it in this respect is the Journal of the Royal Naval Medical Service.

Because the NAVAL MEDICAL BULLETIN is so widely read and carries the name and prestige of the Medical Department of our Navy into so many places, it is desired to do everything possible to improve it and make it of more value to its readers. The object of the questionnaire is to obtain comments and suggestions for improvement, opinions as to new features, and the relative interest in particular sections. Frank criticism is invited.

It must be stated that the BULLETIN is published on a budget and restrictions of economy have to be considered.



QUESTIONNAIRE

Answers to the questions on this page will, it is believed, be helpful in making the **NAVAL MEDICAL BULLETIN** of greater value to its readers. The replies will be analyzed, collated, and such subjects as seem likely to result in improvement will be put into practice if possible. After filling in the answers, please cut along the ruled edge and return to the Editor, U. S. NAVAL MEDICAL BULLETIN, Bureau of Medicine and Surgery, Navy Department, Washington 25, D. C.

1. Should the Bulletin be published—

- a. Monthly
- b. Bimonthly (as at present)
- c. Quarterly

2. What Section of the Bulletin do you like best?

- a. Surgeon General's Letter
- b. Main Articles
- c. Editorials
- d. Clinical Notes
- e. Book Notices
- f. Preventive Medicine

3. Name any additions you would like such as a question box, medical history page, medical and nautical humor column, or any other feature.

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4. Comment, suggestions and criticisms. (Continue on back of page if not sufficient space here.)

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CLINICAL NOTES



RECURRENT INGUINAL HERNIA

Report of Two Unusual Cases

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and
LEWIS L. HAYNES
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These two rather unusual types of recurrent hernia were encountered by one of the authors in two consecutive herniorrhaphies. We have no intention of subjecting our reader to a long review or discussion of the subject. On the other hand, a brief presentation of the cases and a short discussion of them would seem worth while, emphasizing, among other things, the importance of careful exploration at the operating table of the three common sites of herniation in the inguinal-femoral region.

CASE REPORTS

Case 1.—The patient, a white male, age 44, was admitted to the hospital on 21 January 1947 with a chief complaint of "recurrent hernia." A right-sided inguinal hernia had been found and repaired in 1939. A few months after the operation the patient again noted swelling in the right inguinal region. However, it was only with considerable weight loss in the past 2 years that the recurrence of the hernia became quite obvious, and was associated with some discomfort. The swelling had remained easily reducible throughout.

Physical examination was essentially negative except for the inguinal regions. On the right the scar of the previous operation was noted. The external ring was moderately dilated and protruding from it was a small, easily reducible mass which transmitted a cough impulse. In addition there was a larger mass with similar characteristics, lateral to the first one, and apparently extending beneath Poupart's ligament into the femoral region. On the left side, also, a small hernial sac protruded through the external inguinal ring.

Operation was performed on 22 January 1947. The scar of the previous herniorrhaphy was excised down to the aponeurosis of the external oblique muscle. This latter structure, which had been imbricated, was divided down to the external ring to open the canal. At this point it was obvious that a Ferguson-type repair had been performed previously and it was necessary to divide the remnants

of the conjoined tendon-Poupart's ligament layer to expose the cord which was then mobilized from its bed in the canal.

Two definite hernial sacs were present. One of these was a direct recurrence which had protruded through the external inguinal ring. The other and larger sac passed beneath the attenuated inguinal ligament into the femoral region below (fig. 1).

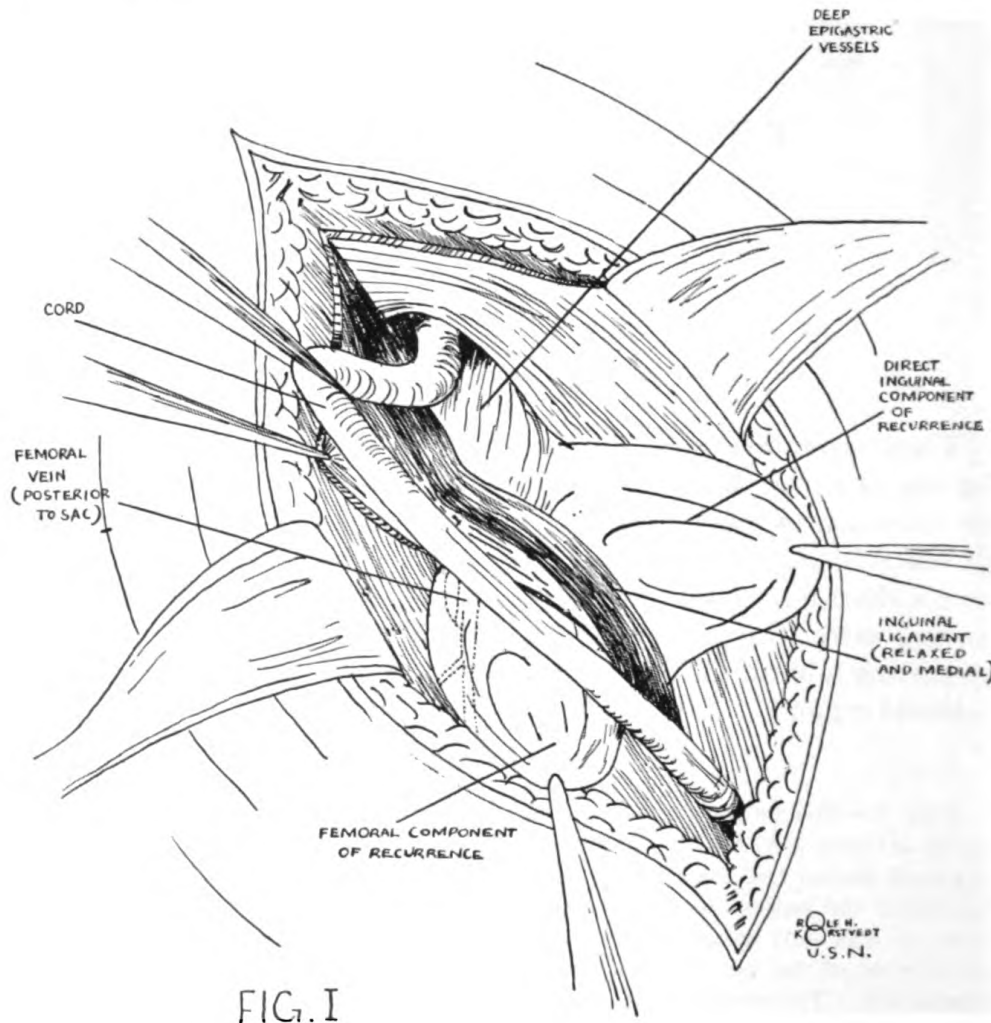


FIG. I

The wide neck of the femoral recurrence filled the entire space beneath the medial half of the ligament, lying in front of the femoral vessels in its lateral aspect. The hernial sacs were opened and excised in the usual manner. Poupart's ligament was sutured to Cooper's ligament to take up the slack in the former structure and to close the femoral canal. The remnants of the transversalis fascia were approximated to reconstruct the floor of the inguinal canal. A Halsted type of herniorrhaphy was then completed, using stainless steel wire sutures throughout. Left herniorrhaphy was deferred.

Case 2.—A 46-year-old male was admitted to the U. S. naval hospital on 23 January 1947 with a chief complaint of "recurrence of bilateral inguinal hernias." Ten years prior to admission he was operated on for bilateral inguinal hernias

at another hospital. He suffered no complaints postoperatively and continued in his work as a plumber for 6 years until he noticed a recurrence on the right side, which was again repaired. About 6 months prior to admission both sides again recurred. The right hernia, at the time of admission, was associated with pain on straining. Both hernias could be reduced easily by the patient.

The physical examination revealed a tall, slender, white male. The physical examination was negative except for the abdomen which revealed a healed nephrectomy scar and right and left herniorrhaphy scars. On straining, a large, soft mass appeared in the right inguinal canal which transmitted a cough impulse, and a smaller mass appeared in the femoral triangle. On the left side a similar, but smaller, inguinal hernia was present but no femoral mass could be demonstrated. All laboratory tests were within normal limits. On 27 January 1947 repair of the right recurrent inguinal hernia was done under pontocaine spinal anesthesia. The right inguinal scar was excised and the cord structures were found to lie in the subcutaneous tissues. A Halsted type repair had been done

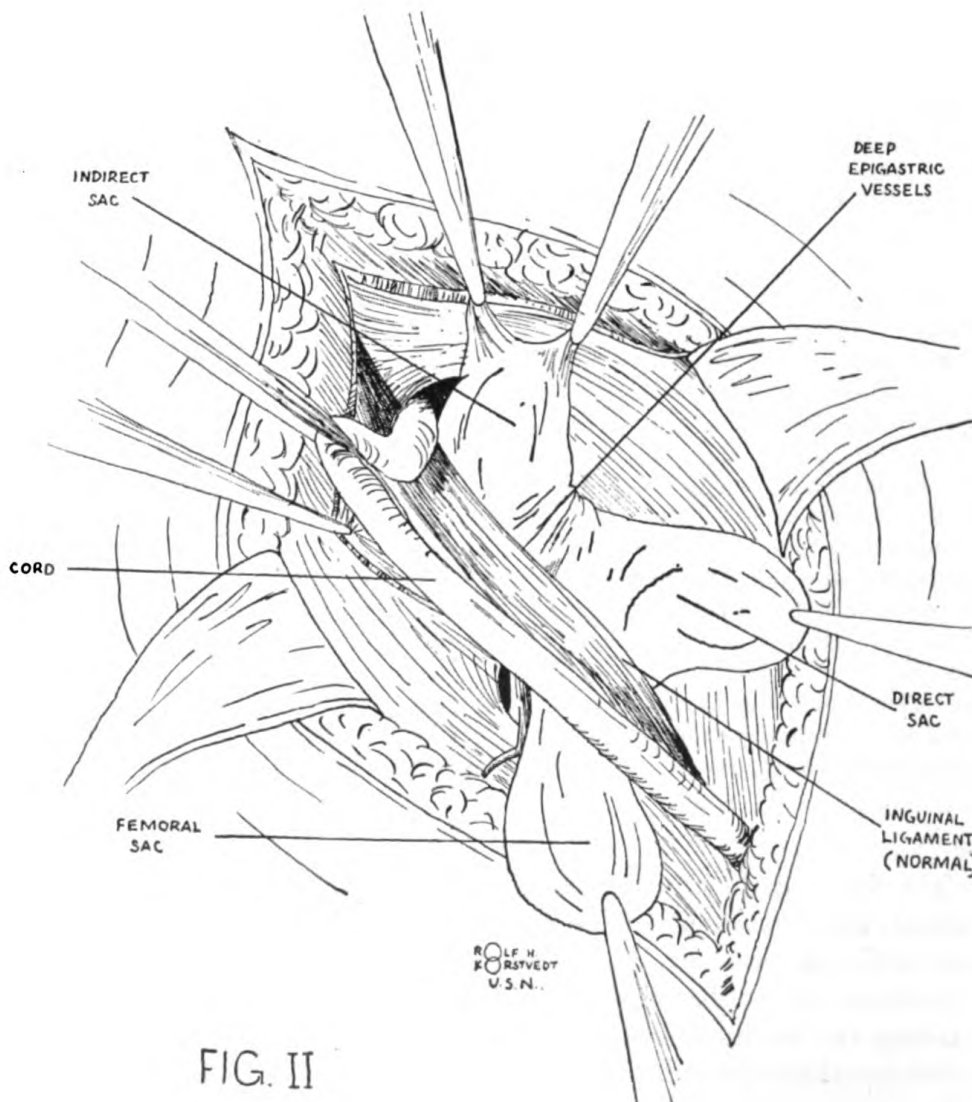


FIG. II

previously. The structures of the cord were freed from the internal ring to a point well below the pubis and retracted from the field. The imbricated external oblique was divided and the conjoined tendon and Poupart's ligament were separated by taking down the remnants of the previous herniorrhaphy. It was now possible to demonstrate definite hernial sacs in three areas (fig. 2). There was a good-sized indirect inguinal hernia with the sac coming out along the cord. There was a large direct bulge and in addition there was a good-sized femoral hernia at the usual site. The sac of the indirect inguinal hernia was separated from the structures of the cord, transfixated, ligated, and the excess sac was removed. The femoral hernia was treated from above. The transversalis fascia overlying its neck was divided, and the hernial sac was brought up, ligated at the neck, and excised. The direct hernia bulge was not opened. The femoral opening was closed by vertical mattress sutures between Poupart's and Cooper's ligaments. Two medial ones were of heavy steel wire (0.010), and the lateral one of cotton No. 10. The transversalis fascia was then closed and reefed with interrupted sutures of fine catgut. This reduced the direct bulge. A Bassini type repair was done with stainless steel wire. The patient left the operating room in good condition. The postoperative course was uncomplicated. Ambulation was started on the first postoperative day and the sutures were removed on the seventh postoperative day. Healing was by primary intention.

On 14 February 1947 the left side was taken down as on the right side. A defect about the size of a quarter was discovered at the lower angle of the old repair through which protruded a large direct sac which was dissected free and opened. The exploring finger revealed an indirect inguinal hernia with the sac coming along the cord and a femoral hernia extending $1\frac{1}{2}$ inches beyond Poupart's ligament into the femoral triangle. The transversalis fascia was divided. The femoral hernia was reduced and the repair was accomplished from above by approximating Poupart's ligament to Cooper's ligament with interrupted sutures of cotton No. 10. The indirect sac was dissected free from the cord structures down to the internal ring, ligated, and the redundant portion of the sac was amputated. The direct sac was then dissected free on the medial side down to the margin of the bladder. The opening was closed with a purse-string suture. The redundant peritoneum was amputated. The transversalis was closed and reefed with cotton No. 10. The rectus sheath was split and a flap of fascia was swung over Hesselbach's triangle and sutured to the suprapubic tract of the transversalis fascia and to the shelving edge of Poupart's ligament. A modified Stewart Lee repair was then done using cotton No. 10. The patient left the operating room in good condition. The postoperative course was uncomplicated. The sutures were removed on the seventh postoperative day and the patient was allowed to ambulate on the fourteenth postoperative day. He was discharged to his home on 1 March 1947.

DISCUSSION

The first step in proper treatment of recurrent hernias is a careful preoperative examination and evaluation of the recurrence. It is not sufficient to know that a patient has a bulge beneath his herniorrhaphy scar. Every effort should be directed toward determining whether the hernia is femoral or inguinal in location, its size, its relationship to the cord and the external ring, et cetera. With this knowledge at our disposal the taking down of a previous unsuccessful or

incomplete repair becomes much easier and safer, even in the presence of dense scar tissue to obliterate or distort familiar landmarks. The previous repair should be completely dismantled, in most instances, in order to confirm our preoperative evaluation of the situation and to carefully examine for multiple or complicated types of recurrence.

In case 1 the femoral hernia was not, either as to location or configuration, of the common variety which is generally thought to develop on a congenital basis, entering a performed pouch or diverticulum to descend through the femoral canal medial to the vessels. It is our feeling that Poupart's ligament was drawn upward and medialward, perhaps by the complete imbrication of the aponeurosis of the external oblique at the previous operation. This allowed a portion of the direct bulge in the inguinal region to protrude beneath the ligament and produce a pantaloon type hernia, femoral-inguinal in type, with the inguinal ligament at the "crotch." It is surprising to us that a recurrence beneath the inguinal ligament does not occur more often in the repair of a large direct inguinal hernia when, as practiced by some surgeons, the edge of the rectus sheath is sutured to Poupart's ligament under great tension with heavy sutures. It is our opinion that in such cases the ligament is drawn up to the sheath rather than the reverse being true, as is commonly believed.

In case 2 triple hernial sacs were found bilaterally. On the right it had been recognized preoperatively that the patient had a femoral as well as an inguinal hernia. In this instance, the femoral hernia was a typical one passing down through the femoral canal beneath a strong, tight inguinal ligament and the preformed pouch may well have been present and overlooked at the previous repairs. This in itself is not an unusual situation but has not in our experience been associated with both direct and indirect "recurrences" in the inguinal region.

On the left side of the second patient, preoperative examination had not yielded comparable information about the true situation. However, following the usual procedure, the operator completely dismantled the previous repair and opened the presenting direct inguinal sac for a more adequate digital examination of the hernial orifices. Again both indirect and femoral sacs were demonstrated although they were empty of content at the time of examination. Had this routine procedure not been followed either or both of these complicating hernias might have been overlooked, as the direct sac was very definite and complete, and was undoubtedly the one demonstrated preoperatively.

In this presentation we are making no brief for the type of hernial repair nor the type suture material used in each instance. As can be seen from the operative notes, the authors themselves do not agree on either point. Neither are we making a point of early ambulation after herniorrhaphy, although it was practiced after two of the three repairs.

SUMMARY

1. Two unusual cases of recurrent combined inguinal and femoral herniae are presented.
2. The necessity for careful preoperative examination is stressed.
3. Complete dismantling of the previous unsuccessful repair is advised as the first step in evaluation of the situation at the operating table.
4. Intraperitoneal digital exploration of the inguinal and femoral hernial orifices should be practiced in order to avoid overlooking any one of the multiple recurrences.



EOSINOPHILIC GRANULOMA OF BONE

With Report of Two Cases

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and

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This peculiar bone lesion was simultaneously described in 1940 by Otani and Ehrlich (1) and Lichtenstein and Jaffe (2). The former described it under the name "solitary granuloma of bone," the latter under the name "eosinophilic granuloma of bone." Farber in 1941 (13) and Green and Farber in 1942 (5) confirmed the occurrence of similar lesions in the same patient. They proposed the name "destructive granuloma of bone," and were the first to interrelate this lesion of bone to that of Letterer-Siwe's disease and that of Hand-Schüller-Christian disease. The name "eosinophilic granuloma" has been widely accepted. Jaffe and Lichtenstein (4), in defending their choice of the name, state that the term "solitary" is inappropriate as the lesions are frequently multiple, and that the term "destructive" is nondescript as there are other destructive granulomatous lesions of bone such as syphilis. The denomination "eosinophilic" hinges on the idea of the eosinophils which hallmark the lesions histologically. Similar lesions have previously been described (6) (7) (8) but not as a distinct entity, and under such headings as myeloma, granulation tumor and osteomyelitis, but always with an accompanying eosinophilic reaction.

Eosinophilic granuloma of bone is a destructive lesion, in which conspicuous sheetlike collections of histiocytes constitute the basic component of the lesion, interspersed with varying numbers of eosinophilic leukocytes. Up to February 1947, 65 acceptable cases have been reported (3) (9) (10) (14) (15).

¹ Resigned 27 March 1947.

ETIOLOGY

The cause of eosinophilic granuloma is as yet unknown. Most authors believe that it is related to the Schüller-Christian disease and the Letterer-Siwe's disease in that all three are different expressions of the same basic disorder. The lesions are characterized in the beginning by the presence of large numbers of histiocytes, which is the basic pathology of all three diseases. Though no infectious agent has been discovered as yet, the most reasonable hypothesis is that it is an inflammatory response to an unknown agent. The association of trauma to the onset of symptoms is frequent, but this is not consistent and often is not present.

CLINICAL FEATURES

Eosinophilic granuloma of bone may occur as solitary or multiple lesions. Up to 25 separate lesions have been reported in 1 patient (5) occurring in various bones. The disease occurs more commonly in children and young adults, but may occur in older age groups. Of the 67 recorded cases to date, including our 2, it will be noted that 80 percent of the cases occur before the age of 30 years.

The ratio of males to females in the cases reported is approximately 5 to 1.

With the possible exception of the bones of the hands and feet, apparently any bone in the body may be affected (4). Those most commonly involved are the flat bones and especially those of the cranial vault, the ribs, and vertebrae, also the humerus and femur. The symptoms are usually local and arise from the skeletal involvement and include pathological fractures or symptoms arising from involved collapsed vertebrae. Systemic manifestations are lacking or minimal even in multiple bone involvement. Pain, tenderness, doughy swelling, and redness may occur over the affected areas. Sometimes the lesions may be asymptomatic. Slight fever and weight loss has been reported (11). A mild leukocytosis, and eosinophils of 4 to 11 percent have been noted. Blood chemistry estimations, including calcium, phosphorus, phosphatase, and cholesterol, have been consistently within normal limits. Bence-Jones protein is absent from the urine.

X-ray examinations reveal well-demarcated round or irregularly shaped areas of decreased bone density with a punched-out effect varying from 1 to 4 cm. in diameter. On recovery the lesions may disappear roentgenologically. In the differential diagnosis of the solitary lesions consider: Osteomyelitis, tuberculosis, syphilis, solitary bone cyst, and giant cell tumor. In the differential diagnosis of the multiple lesions consider: Multiple myeloma, metastatic tumors, osteitis fibrosa cystica, or Ewing's tumor.

PATHOLOGY

It is a **granulomatous** lesion causing bone destruction. In the early stages the lesion is characteristically cystic and hemorrhagic and contains soft friable yellowish-brown material, due to necrosis or lipid infiltration. The early lesions microscopically show areas of bone destruction infiltrated by large numbers of eosinophiles and phagocytic mononuclear cells, together with varying numbers of lymphocytes, plasma cells, and polymorphonuclear leukocytes (5). Phagocytic giant cells may be seen in the vicinity of the necrotic material. The large mononuclear cell or histiocyte, which is considered the characteristic or basic cell, has a round to oval or horseshoe-shaped (sometimes double) nuclei, and coarsely granular, vacuolated or foamy cytoplasm. In the early stage, however, the eosinophil is the predominant and most conspicuous cell.

As the disease progresses, the eosinophiles may disappear and fibroblastic ingrowth becomes evident. According to Green and Farber (5) the histiocytes show more vacuolization in the older lesions and have the typical appearance of foam cells seen in xanthoma, which they have called "lipophages." Later in the healing process there is proliferation of connective tissue and eventually regeneration of bone. Healing by resolution may also occur without passing through a "lipogranulomatous" stage (4). A histopathological examination is necessary for a definite diagnosis.

Farber (13) was the first to suggest that anatomically the underlying lesion of eosinophilic granuloma is related to the lesion of Schüller-Christian disease and that of Letterer-Siwe's disease. It is now generally agreed that the three diseases constitute different clinical expressions of the same basic disorder which appears to be an inflammatory histiocytosis. This was elaborated upon by Mallory (12) who considered eosinophilic granuloma as a comparatively benign and much more localized form of the disease process in which the lesions seemed to involve the skeleton only and frequently only a single bone.

In Letterer-Siwe's disease (or nonlipoid histiocytosis), on the other hand, the malady appears in infancy or very early childhood, is often rapidly fatal, though the patient may live 1 to 2 years or more. In this latter disease, the lesions are widely distributed, involve other tissues (notably lymphoid tissue) as well as the skeleton. This is the gravest form of the malady.

In Schüller-Christian disease (lipogranulomatosis) the disorder assumes a less severe but more chronic form and appears in older age groups as well as in children. This disease is not limited to the skeleton, as the lung, heart, and other organs may be involved. The lesions of the Schüller-Christian syndrome histologically tend to undergo more collagenization and lipidization than either of the other two, but

the basic histiocytosis of this and the others are similar. Especially when the Christian triad of symptoms, viz: calvarial defects, exophthalmus (from involvement of orbital bones), and diabetes insipidus (from involvement of sphenoid) have developed, then the disorder is labeled Hand-Schüller-Christian disease.

It is most interesting to note that two of the most recent cases of eosinophilic granuloma to appear in the literature (14) (15), report associated lung lesions in the form of nodular parenchymal infiltrations, which in both instances cleared under radiation therapy. These were the first visceral lesions reported with this disease, and if actually proven to be similar lesions histologically to those in the bones, it might serve as an added proof of the close relationship to the Letterer-Siwe's syndrome. This phase of the disease is a new observation and needs further study.

It will be interesting to watch further developments along this line, and to have chest x-rays routinely in all cases of eosinophilic granuloma.

TREATMENT

There is no specific treatment. Healing of lesions follow after either surgical curettage or small doses of radiation. Spontaneous healing has also been observed. Recovery is usually complete from several months to a year or more, whether the lesions are treated or not.

PROGNOSIS

The disease is benign and prognosis is excellent. Recovery has been reported in all proved cases. New lesions may appear as old ones are being treated. One was reported as appearing 2 years and 8 months after known onset (5). Lesions are usually completely healed by x-ray examination about 1½ years after onset. The presence of visceral lesions such as those recently mentioned as occurring in the lungs may very well modify this otherwise excellent prognosis where the skeleton alone is involved.

CASE REPORTS

Case 1.—W. L. C., S1c, 19-year-old white male admitted on 13 January 1947.

Present illness: About 2 months prior to hospital entry, this patient was struck over the right eye while in a fist fight. He received small cuts above and below the eye which healed quickly. One week later, he began to have pain and swelling above the eye which receded and returned three or four times, but which had become gradually worse and had remained so for 1 week prior to entry.

Past history: He states that he has always been in good health. Systems negative. A tonsillectomy at the age of 14 years was the only previous surgery.

Family history: Irrelevant.

Physical examination: A well-developed, well-nourished 19-year-old white male, not appearing acutely ill. Examination of the head revealed a soft doughy swelling over the lateral $\frac{1}{3}$ of the right supraorbital rim extending about $1\frac{1}{2}$ inches upward and $1\frac{1}{2}$ inches laterally, and downward, involving the upper eyelid. The right conjunctiva was slightly injected, temperature 99° F., pulse 84, respirations 20, but the remainder of the physical examination was entirely normal.

Laboratory: Admission urine and Kahn tests were normal. Hemoglobin was 14 grams; white blood count 9,700, with 1 percent bands, 72 percent segmented, 23 percent lymphocytes, and 4 percent eosinophils. Anteroposterior and lateral skull x-rays of 20 January 1947 (see fig. 1) showed an area of bone rarefaction measuring 2.2 by 1.8 cm. situated in right frontal region opposed to the outer half of the supraorbital margin with involvement of the border. Skull was otherwise normal.

Treatment and course: With the impression that we were treating a chronic frontal bone osteomyelitis, it was decided to give the patient 1 week of penicillin (40,000 units every 3 hours), and then explore the frontal bone surgically. This was carried out and surgery was performed on 29 January 1947.

Procedure: Through a 3-inch incision in the right eyebrow, a mass was encountered under the skin at lateral one-third of the eyebrow. This was eroding through outer plate of the frontal bone, 1 inch in diameter and through the periosteum. This mass was soft, yellow, with hemorrhagic areas and fungating, spreading in all directions. The posterior plate of the frontal bone and the superior orbital plate were eroded through. The mass was attached to superior surface of dura. All of the mass was removed except for some dural attachments. A penicillin-soaked gauze packing was left in the cavity and the incision

closed. A frozen section taken when the mass was first exposed revealed an eosinophilic granuloma.

The patient's condition postoperatively was good and he received a 500 cc. blood transfusion, and 1,000 cc. 5 percent dextrose the afternoon of surgery. The temperature rose to 100° F. the first postoperative day and penicillin parenterally was started. The temperature became normal on the second day and the packing was removed on the fourth day. The wound was healed on the sixth day and x-ray therapy was begun on the tenth postoperative day. A culture from the operative cavity taken at the time of surgery showed no growth.

Further Laboratory Studies

Pathology report: Grossly the specimen consisted of soft, friable, yellowish brown tissue with areas of hemorrhage and necrosis, and



FIGURE 1.—Anteroposterior view of skull of case 1 showing bony defect of frontal bone, above and lateral to orbit.

containing some bone fragments. On microscopic examination the sections revealed granulationlike tissue. There was a delicate background of fibrous tissue in which many histiocytes were present, some with abundant ground-glass-like cytoplasm. There were enormous numbers of eosinophils together with a few plasma cells, and some lymphocytes. There was a patchy necrosis throughout. (See fig. 2.)

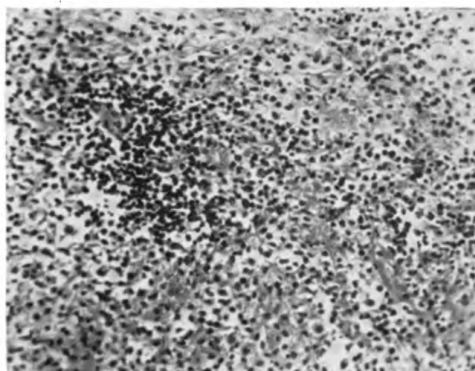


FIGURE 2.—Low power microphotograph of case, showing background of histiocytes. The collection of black-appearing cells to left of center is mostly eosinophils. Hematoxylin and eosin; $\times 100$.

Postoperative x-rays of the skull revealed the operative defect but no other pathology. Further x-rays of the long bones, the pelvis, and the chest revealed no pathology. Urine examination for Bence-Jones protein was negative, and blood calcium, cholesterol, and serum phosphatase were within normal limits. He received a total of 800 R units of x-ray over a period of 24 days to 2 areas in right frontal region.

At the present time, 10 weeks following surgery, he is completely free of symptoms and has no evidence of any recurrence.

Case 2.—P. J. T., F1C, 18-year-old white male, admitted 14 August 1946.

Present illness: For 4 months prior to hospital entry this patient had been having throbbing headaches in the right frontal region radiating to the occiput. These were precipitated by walking in front of the air blowers on the ship and would last about 1 day. He also had noticed a tender lump on the right forehead for the past week.

Past history: In 1943 he had an external operation on the right frontal sinus, but had had no difficulty until the present time. No other surgery or serious illness otherwise.

Family history: Noncontributory.

Physical examination: Temperature 99° F., pulse 88, respiration 18. There were three small swellings under the scalp on the frontal bone high in the midline and one laterally toward the temple on the right side. These were doughy and tender to palpation, and the largest was about 1½ cm. in diameter.

Laboratory: Admission urine and Kahn tests were normal. X-rays of the sinuses and frontal bone revealed diffuse slight clouding throughout the sinuses and several small areas of diminished bone density, with surrounding sclerosis above the frontal sinuses in the frontal bone. (See fig. 3.)

Diagnosis: The diagnosis was in doubt. Multiple myeloma was strongly considered.

Treatment and course: One of the small enlargements of the frontal bone was biopsied by curettage on 12 September 1946, under local anesthesia. Microscopic section revealed granulationlike tissue, some areas of which were fairly dense and others loose and myxomatous appearing. Scattered throughout were many lymphocytes, plasma cells, and a few polymorphonuclear leukocytes. In addition there were many large macrophages, or histiocytes, some containing double nuclei. The cytoplasm of some of these cells were foamy in appearance, apparently due to contained lipids. The pathological impression was a benign granuloma, believed to be a stage of eosinophilic granuloma, without eosinophils.



FIGURE 3.—Anteroposterior views of skull in case 2, showing multiple bony defects centrally and two over right frontal bone.

Complete blood counts, sedimentation rates, blood cholesterol, calcium, and serum phosphatase were within normal limits. X-rays of the chest, long bones, and pelvis revealed no pathology.

On 12 October 1946 two more areas were curetted surgically.

On 21 October 1946 x-ray therapy was begun to the skull lesions. The swelling persisted and on 26 November 1946 a flap operation was performed and three areas were curetted out, two of which were hard and the third soft. Microscopic examinations revealed the same findings as previously described on the biopsy.

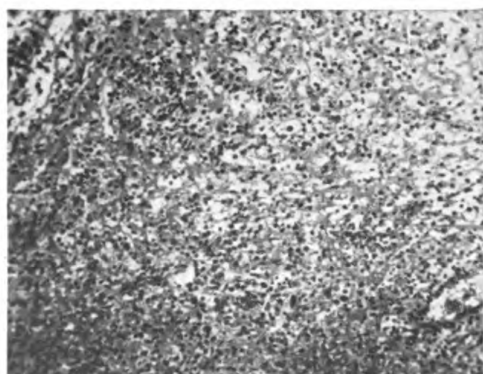


FIGURE 4.—Low power microphotograph of case 2. The histiocytic stroma can be seen, also a diffuse infiltration of lymphocytes and plasma cells, with only a few scattered eosinophils. Hematoxylin and eosin; $\times 100$.

He received a total of 700 R units to each of two areas and 800 R units to the third area.

During his hospital stay his general health was good at all times and on 9 December 1946 he was returned to duty with his external wound well healed, but x-ray findings essentially unchanged. One month later, on 8 January 1947, the patient was readmitted to another naval hospital with appearance of a swelling and bone defect in the left forehead, which was curetted. The slides showed a similar type of lesion as was found at this hospital earlier, except for the presence of a few eosinophils. (See fig. 4.)

Comparison of our earlier plates with those taken 5 months later (24

March 1947) showed not only no apparent increase in size of the bone defects first noted by us, but they were partially filled in with calcification. There was a new rarefied bone defect on the left side, the site of the recent lesion.

Complete recheck laboratory studies including blood chemistry and x-ray examination of all bones on recent hospital admission, revealed nothing of note, and no other bones involved. He remained robust, afebrile, and with only minimal local symptoms.

This we believe to be a case of eosinophilic granuloma, in which there are now only a few scattered eosinophils and in which none were found in two earlier biopsies.

CONCLUSIONS

1. The literature has been reviewed and discussed as to the etiology, clinical features, pathology, treatment, and prognosis. An effort has been made to convey the present viewpoint that eosinophilic granuloma, Letterer-Siwe's and Hand-Schüller-Christian disease may be different clinico-anatomic expressions of the same basic disorder. Emphasis has been placed on the pathological similarity microscopically, with similar basic cellular structure present in all three, namely the large mononuclear histiocyte.

2. Two more cases are added to the literature, with response of one to the treatment of combined surgery and x-ray therapy, but with the appearance of a new lesion in the other, while earlier multiple skull lesions are healing.

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EOSINOPHILIC GRANULOMA OF BONE

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Eosinophilic granuloma is the term proposed by Lichtenstein and Jaffee (1) in 1940 for what they considered a new disease entity of bone. As in their other publications suggesting new osseous lesions, previously overlooked, these authors culled the literature and added several cases described under a variety of names to their single case of so-called eosinophilic granuloma. In 1929, Finzi (2) described a lesion of the frontal bone in a 15-year-old boy and called it "myeloma with prevalence of eosinophile cells." A year later Mignon (3) published a report on "granulation tumor of the frontal bone" in a boy of 12 years. Two cases of "osteomyelitis with eosinophilic reaction" were described by Schairer (4) in 1938. An article by Otani and Ehrlich (5) appeared in the literature just prior to the original publication of Lichtenstein and Jaffee, in 1940, mentioning seven cases of identical histology and suggesting the term "solitary granuloma" for this peculiar destructive granulomatous lesion. These authors considered the possibility of early lipoid granuloma but felt that it was not applicable to the seven lesions described. Other cases were recorded by Hatcher (6), Kernwein and Queen (7) and Bass (8). Green and Farber (9), Gross and Jacox (10) and Mallory (11) have

contributed materially to the understanding of the subject. These writers are firmly convinced that eosinophilic granuloma does not represent a new disease entity, but rather a variant of the lipogranulomata and therefore definitely related to Hand-Schüller-Christian's disease, solitary xanthoma and the so-called non-lipoid reticulo-endotheliosis or Letterer-Siwe's disease. Jaffee and Lichtenstein (12) also consider these disease processes as different clinico-anatomic expressions of the same basic disorder. They further suggest that the disorder apparently represents a peculiar inflammatory reaction to some obscure infectious agent.

CASE REPORT

F.S.M., a 21-year-old white male, was admitted to the U. S. Naval Hospital, Bethesda, Md., on 22 October 1946 with the chief complaint of pain and swelling of the forehead just above the right eye. He had been completely asymptomatic until the latter part of August 1946 when he first noticed a severe generalized headache which was more marked over the right eye. At that time there was no swelling or tenderness in the area and no other symptoms were noted. The headache lasted about 24 hours and then subsided spontaneously. Except for an occasional mild pain over the right eye, lasting a few minutes, the patient had no further complaints until 3 weeks later at which time he began to notice a definite but barely palpable tender swelling just above the right eyebrow. There was no discoloration or increased warmth. The lesion became progressively larger and reached its maximum size about 3 weeks after it was first noticed. At this time it had become extremely painful to touch and was hard and immovable. A month later the size of the mass had diminished somewhat; it had become soft and the pain had subsided. The patient gave no history of chills, fever, trauma or previous sinus infections.

Examination on admission revealed a well-developed and well-nourished, slightly anxious white male in no apparent distress. The pupils were round, equal and reacted to light and accommodation. The fundi were normal. Examination of the skull revealed a slightly raised (4–6 mm.) fluctuant area over the right eyebrow $2\frac{1}{2}$ cm. in diameter. The mass seemed to be firmly attached to the underlying structures. Physical and neurological examinations were otherwise negative.

Complete blood and urine studies were all within the normal range. Serologic tests were negative for syphilis. No Bence-Jones protein was found. Acid phosphatase was 3.6 units and alkaline phosphatase was 2.8 units (Bodansky) per 100 cc. of serum. Roentgenologic examination of the chest, spine, and extremities revealed no abnormalities. Skull films showed a well-delineated punched-out area, approximately $1\frac{1}{2}$ cm. in diameter in the right frontal bone immediately superior to the supraorbital rim. An electroencephalogram indicated a focal electric abnormality in the right frontal region.

On 19 November 1946 the patient was taken to the operating room and under intratracheal ether anesthesia a small frontal craniotomy skin incision was made. The scalp was reflected downward until a soft grayish mass, extending through the bone and pericranium, was encountered. The pericranium around the margin of the bony defect was removed and a small amount of bone at the periphery of the defect was rongeured until normal dura was seen. The tumor was dissected free easily and lifted from the dura. In so doing it was found that the tumor had extended through bone into the right frontal sinus. The lining membrane

of the sinus was intact and normal. The mass was removed in its entirety. The frontal sinus and the operative defect were packed with iodoform gauze. The wound was closed with interrupted mattress sutures of 0.007 tantalum wire and the ends of the two iodoform gauze packings were brought out through the temporal area of the incision. Both packings were removed slowly over a period of 6 days, that in the frontal sinus being removed first.

During the healing of the wound, areosol penicillin inhalations were given. The postoperative course was uneventful and the wound healed per primam. Three months following the first operation, the cranial defect was repaired by a tantalum cranioplasty. At this time there was no evidence of recurrence of the tumor. The postoperative course following the cranioplasty was uneventful and a satisfactory cosmetic result was obtained.

PATHOLOGIC EXAMINATION

The tissue submitted was approximately 3 cc. in volume. It was soft, friable, and moderately hemorrhagic. Yellowish-brown granulation tissue was scattered throughout producing a mottled and variegated appearance. Small areas of necrosis and several minute cystic areas were observed. On microscopic examination, the most striking change was the myriads of closely packed, well-formed eosinophilic cells. The majority of these cells were adult eosinophils although in many areas eosinophilic myelocytes were noted. The fundamental cytologic response, however, consisted of numerous large macrophages or histiocytes. Some of these cells contained single nuclei most of which were large, round or oval, and sometimes kidney-shaped. Occasional binucleated and trinucleated forms of these cells were observed. A few showed longitudinal creasing which is so commonly seen in immature monocytes and reticulum cells. The cells revealed abundant vacuolated cytoplasm and phagocytic activity was marked. Many contained fat droplets as well as erythrocytes, polymorphonuclear leukocytes and an occasional hemosiderin granule. Often the histiocytes were arranged in solid sheets but for the most part the cells occurred singly or more commonly in cords and small foci. They sometimes formed concentric rings about the small capillaries producing a rather unusual peritheliomatous pattern. Areas of coagulation and liquefaction necrosis were present but there was no evidence of caseation or tubercle formation. A few multinucleated giant cells of the Langhans type were noted, however. Scattered diffusely throughout were small areas of hemorrhage and extracellular hemosiderin pigment. The stroma in some areas was composed of a finely reticulated lacelike matrix while in other areas typical granulation tissue was present. Focal zones of dense fibrosis were sometimes encountered especially at the periphery of the lesion. A majority of the bony spicules were necrotic and showed numerous Howship's lacunae. These latter were being formed not by osteoclastic activity but apparently by granulation tissue resorption. There was no evidence of creeping substitution. Also at the periphery of the lesion intramembranous bone formation was observed occasionally. Osteoblastic activity was rather marked in such areas. Nowhere did the cytologic response assume a sarcomatous appearance.

The slides were sent to Dr. Phemister who concurred in the diagnosis of eosinophilic granuloma of bone. Dr. Geschickter, on the other hand, felt that although the disease could be justifiably classed with eosinophilic granuloma, the sections suggested the possibility of an inflammatory response to a low-grade localized osteomyelitis.

At the present time there have been somewhat over 50 published cases accepted as eosinophilic granuloma of bone. Most of the cases

have been in male adolescents or children but the age group has ranged from 6 months to 58 years. The sites of osseous involvement were, in the order of frequency: the skull, the long bones, the ribs, and the scapulae. Both solitary and multiple lesions have been encountered. The only significant laboratory findings occurred in the blood and these were not consistent. A mild to moderate leukocytosis with a rise in eosinophils varying from approximately 2 to 11 percent were noted. Blood cholesterol levels were never abnormal, although they are usually elevated in lipoid granulomatosis. A majority of the patients had mild to severe pain with some swelling of soft tissues and tenderness over the site of the lesions. The duration of such symptoms varied from a few days to several months. A few patients have had mild systemic symptoms such as fever, anorexia, lassitude, headache, and weight loss.

Roentgenologic examination of the osseous lesions, generally characterized by oval or round punched-out defects or irregular areas of decreased density, were associated frequently with erosion of the cortex and periosteal new bone formation in about half the cases. In some instances the lesions could not be differentiated from metastatic carcinoma, multiple myeloma, tuberculosis, or osteomyelitis.

Although the histological findings are fairly uniform, the gross appearance of the curettings varies considerably. Most authors describe tissue that is soft, cellular, and resemble granulations. A yellow tinge representing the xanthomatous areas is frequently noted. No pus is encountered. Variations in the gross and microscopic findings are readily explained by different ages of the lesions examined. The early lesions may appear cystic on gross examination and they frequently show a mottled yellowish-brown red material. The essential cytological response consists of a granulomatous lesion infiltrated with multinucleated giant cells, phagocytes containing hemosiderin, lipoid material, eosinophilic granules or cell debris, and large numbers or even sheets of eosinophils. Mitotic figures, areas of necrosis, osteoblastic new bone formation, and extensive old and recent hemorrhage are observed occasionally. The multinucleated cells are either of the large Langhans or the osteoclastic type. Phagocytes and unusually large mononuclear cells are often arranged in reticular fashion with cytoplasmic communications. The origin of these cells is somewhat obscure; they may represent either wandering macrophages or fixed tissue histiocytes of the reticulo-histocytic system. The characteristic cell is the large mononuclear cell with granular or foamy cytoplasm. These cells often reveal rather striking vacuolization of the cytoplasm in intermediate stages of the disease. This change has been considered as indicating a relationship between eosinophilic granuloma, Letterer-Siwe's disease and Schüller-Christian's disease. In-

deed, Jaffe and Lichtenstein (12) have suggested that the three conditions may be due to an unknown infectious agent, eosinophilic granuloma being the most benign and localized form and limited to bone. In one of the cases reported by Dundon et al. (13), lymph node involvement in addition to a lesion of the sternum was present indicating that this case perhaps represented a transition from eosinophilic granuloma to Letterer-Siwe's disease.

At times the cellular response may simulate sarcoma. In an unpublished case, at the State University of Iowa, one of the authors had an opportunity to study such a lesion. The microscopic sections revealed a granuloma composed of numerous small mononuclear cells, myriads of eosinophils, many multinucleated giant cells, and a small number of lymphocytes. Evidence of old and recent hemorrhage was widespread and hemosiderin-laden phagocytes were plentiful. Reticular or syncytial arrangement of the mononuclear cells was occasionally noted. Mitotic figures, some atypical, were fairly numerous. In addition, there was rather striking pleomorphism of the mononuclear cells. In several areas the long spindle-shaped character of the cells suggested a sarcoma. In this particular case, Phemister, Jaffe, and Lichtenstein rendered the diagnosis of sarcoma, whereas Hatcher favored the diagnosis of eosinophilic granuloma. Clinically the case was also atypical since it was the only one up to that time which recurred following curettage. Extensive necrosis later necessitated amputation. The patient has remained entirely well for 3 years.

There is much to be known before eosinophilic granuloma can be classified with the lipid dyscrasias. The great difficulty encountered in such a discussion is that this group of diseases is quite rare and knowledge concerning them is accordingly very incomplete. Of even more importance is the fact that in this group of diseases the etiology is unknown. This fact alone mitigates against the concept of eosinophilic granuloma as a separate disease entity. It is rather well known that eosinophilia and granuloma formation are rather common cytologic manifestations of the lipid diseases. A blood eosinophilia is often noted. The large mononuclear phagocytes are common to all, and most pathologists feel that the presence of an abundance of lipid material in these cells is required for the diagnosis, particularly in Christian's disease. However, there have been reports in the literature which indicate that lipid-laden macrophages sometimes are not observed in the late stages of this condition. Letterer-Siwe's disease or nonlipoid reticulo-endotheliosis may well represent this phase. In general, however, it may be said that although the clinical picture of Christian's disease is usually lacking in eosinophilic granuloma, the cytologic response is strikingly similar in both. On the other hand, many so-called Christian's disease diagnosed microscopically, show only the bone changes, the exophthalmus and diabetes insipidus

being absent. Clinically, therefore, only relatively few cases of Christian's disease show the characteristic triad of skull defects, exophthalmus, and diabetes insipidus that textbooks insist upon for diagnosis. The lack of knowledge regarding the lipoid granulomata, in addition to the frequent reference to atypical cases in the literature, makes it impossible to rule out eosinophilic granuloma of bone as a variant. Thus we feel rather strongly that eosinophilic granuloma should not be considered a unique morbid process until further information is acquired concerning the lipoid granulomatous diseases in general and particularly until such time that a specific etiologic agent can be incriminated.

For those who argue for the individual identity of eosinophilic granuloma, there is some justifiable evidence. In the first place, the triad in Christian's disease has never coexisted in any case described as eosinophilic granuloma. In addition, marked cholesterolemia is considered an important associated finding and yet has never been demonstrated in any of the latter cases. The more generalized forms of the lipoid diseases, characterized by lipoid deposition in several long bones and in most of the viscera, result invariably in a poor prognosis. In eosinophilic granuloma, lesions are not infrequently solitary, confined to osseous structures and respond readily to curettage or radiation therapy. No death from the disease or attributable to the disease has been reported. Despite these facts, however, we believe that the evidence is overwhelmingly in favor of eosinophilic granuloma being a variant of Christian's disease. When one considers the biologic sequence of events of many of the more common disease processes and appreciates the various manifestations of disease at different stages of it, one cannot but feel that eosinophilic granuloma is nothing but a variant of a more fundamental disease process. Christian's disease may well be another manifestation of some form of unusual lipoid dyscrasia, the fundamental nature of which is still obscure. Geschickter likewise maintains that there is no justification for considering any of the granulomatous diseases of bone distinct clinical or pathological entities (14).

The treatment of eosinophilic granuloma of bone by surgical excision, curettage, or radiation has proved satisfactory in all previously reported cases. Even without treatment of any kind, spontaneous healing is the rule. Some one of the forms of treatment should be carried out, however.

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EXTRAGENITAL CHORIOCARCINOMA OF THE MALE WITH BILATERAL GYNECOMASTIA

Report of a Case

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Extragenital choriocarcinoma in the male, a rare entity, has been reported in various locations such as the urinary bladder (1) (7), retroperitoneal tissues (2) (3) (4) (5), and the anterior mediastinum. The possibilities of extragenital origin of this tumor, as indicated by Laipply and Shipley (7), are either from elements of teratoma

¹ Resigned August 1947.

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or from embryonal rests of the urogenital folds. In any case, as Symeonidis (8) maintains, the tumor originates in trophoblastic tissue. Excellent discussions of the theories of these tumors may be found in the works of Erdman et al. (3), Petillo (10), Ewing (9), and Laipply and Shipley (7).

In order to eliminate the testes as the primary site of origin certain criteria for diagnosis have been adopted. Primarily, this consists of cutting block sections of the testes, 20.0 mm. thick by Kantrowitz, and examining these histologically. The absence of epithelial remnants, epidermoid cysts, and scars which Prym (11) considered as possible remains of primary sites, as well as absence of teratoma, eliminates the testes as the primary source. Laipply and Shipley list seven case reports from the literature and their own case of a primary choriocarcinoma of the superior mediastinum which satisfy the criteria.

The following case report, although it does not satisfy the microscopic criteria for a true extragenital choriocarcinoma, is worthy of report, especially in view of its rarity (eight cases to date), for it presents the major features of that disease.

CASE REPORT

The patient, a white male 21 years of age, was admitted to the sick list at the U. S. Naval Hospital, Mare Island, Calif., on 24 December 1945 complaining of severe pains in the chest made worse by coughing and deep breathing. He was well until a month prior at which time he developed a "cold" characterized by a dry hacking cough. One week later he had sharp intermittent pain in the left infraclavicular region made worse by coughing and deep breathing. Subsequently the cough became productive of thick sputum and occasionally a small amount of red blood. Two weeks before admission he was seized with a severe pain in the left chest anteriorly which "doubled him up" and lasted for about an hour. Four days prior to his hospital admission a diagnosis of acute catarrhal fever was made. The chest pain increased in severity and frequency, and shortness of breath became more intense.

The past history revealed that a chest x-ray taken in March 1945 was negative, and at that time, after a physical examination, he was qualified for submarine duty. However, for the past 3 or 4 months he noticed an increase in the size of both of his breasts and an increase in body hair. The family history was negative.

The physical examination on admission revealed a fairly well-nourished young white male adult, acutely ill and dyspneic. The temperature was 100.8° F., pulse rate 100 per minute, respirations 26 per minute, and the blood pressure 120/80. The extremities and trunk were hairy, and a severe acne vulgaris, especially of the skin of the anterior chest, was noted. The examination of the chest revealed decreased breath sounds and dullness in the left base and numerous fine moist râles were heard throughout the rest of the chest. No abdominal tumor masses were palpable. A genito-urinary examination revealed small testes in the scrotum.

The laboratory results on admission were: white blood count 13,500, hemoglobin 13.0 grams, sputum negative for pneumococci and acid-fast organisms. The blood culture was negative as was the urine.



FIGURE 1.—Mediastinal mass.

urine specimen was positive on 10 January 1946. Before arrangements could be made to carry on further studies and an assay of urinary hormone excretion, the patient died

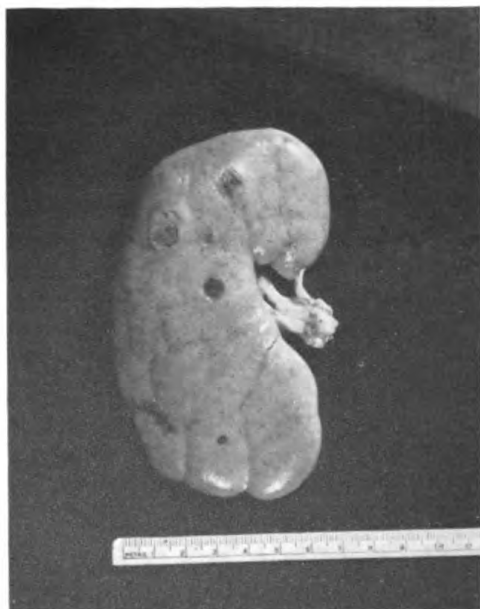


FIGURE 3.—Kidney—metastatic nodules

The chest x-ray taken on admission showed numerous large, discrete, circular shadows in both lung fields and a left pleural effusion. The roentgenologist's impression was "metastatic malignancy of both lungs with pleural effusions."

In spite of transfusions and penicillin the patient steadily became worse. On 8 January 1946 it was suggested that a feminizing tumor on the basis of the gynecomastia, acne vulgaris, small testes, and the chest x-ray, arising either in the adrenal gland, ectopic gonadal tissue or a small nonpalpable testicular tumor was present. A Friedman test on a



FIGURE 2.—Lungs—metastases.

on 14 January 1946, 20 days after admission to the hospital.

An autopsy performed 7 hours after death revealed in the anterior mediastinum (fig. 1) a shaggy, ovoid, brown-red tumor 9.0 cm. long and averaging 6.0 cm. in breadth and depth. Multiple cross-sections of the mass showed a partially necrotic and hemorrhagic tissue. At the lower pole of the mass was a group of cysts lined by a smooth mucosal tissue and containing blood. No cartilaginous nor bony structures could be identified. The tumor extended to and through the pericardium but did not invade the heart. Large metastatic nodules measuring up to 4.0 cm. in diameter and resembling the mediastinal tumor, replaced most

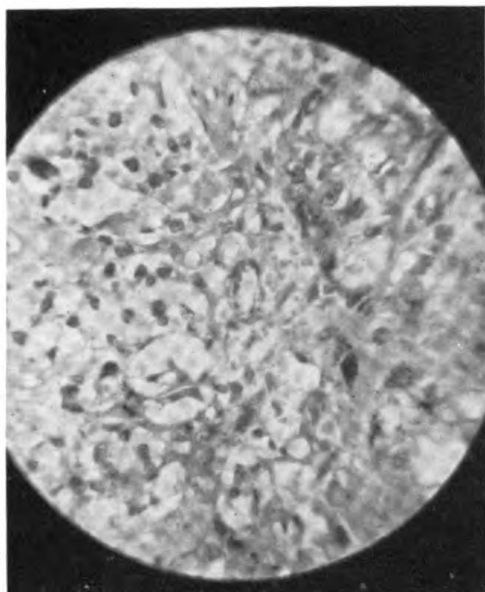


FIGURE 4.—Mediastinal mass showing choriocarcinoma. $\times 430$.

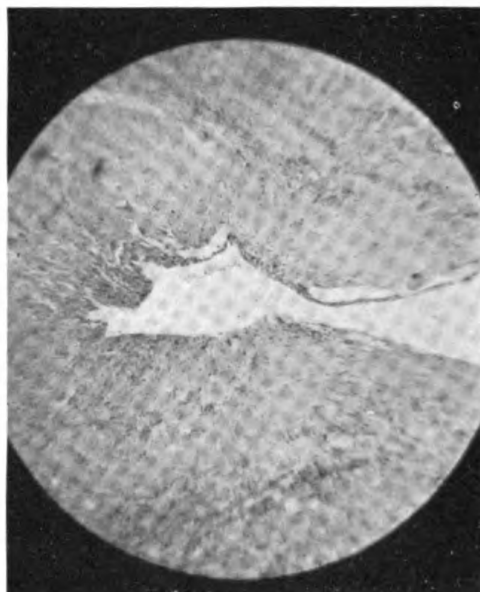


FIGURE 5.—Cyst from mediastinal mass. $\times 100$.

of the normal tissue in both lungs (fig. 2). Metastases were also found in the liver and in both kidneys (fig. 3). The adrenals appeared to be of normal size. The periaortic lymph nodes were not enlarged. The bladder and bladder neck were normal. No tumors nor metastases were noted in the pelvis. Both testes were in the scrotum and were small. However, the tubules appeared to string well. Serial gross sections of the testes, approximately 5.0 mm. thick, revealed no cysts, tumors, nor scar tissue. Also found was a Grade 2 enlargement of the tissue of both breasts.



FIGURE 6.—Section of breast, gynecomastia. $\times 100$.

The microscopic examination of the mediastinal tumor (fig. 4) revealed a marked proliferation of malignant syncytial and Langhans' cells and large areas of necrosis and hemorrhage. The sections through the cystic portions showed two types of epithelial linings. One of the cysts was partially lined by a single layer of cuboidal epithelium with a granular debris in its lumen. Another cyst (fig. 5), was lined by a stratified squamous epithelium which in some areas appeared to be somewhat transitional in type. The cystic structures were suggestive of teratomatous remnants. Sections through the metastases showed choriocarcinoma with no other elements of teratomata. Sections through the breasts (fig. 6) showed a proliferation of the ducts, many of which were moderately dilated. The lining epithelium varied from flattened to stratified columnar epithelium with a loose periductal connective tissue. The stroma was dense and fibrous. Sections through the testes showed a slight atrophy of the tubules with incomplete spermatogenesis and beginning hyalinization of the peripheral margin of some of the tubules. There was an increase in size and number of the interstitial cells of Leydig. No evidence of teratomata, cysts, nor scars were found in the sections taken.

COMMENT

Prior to death a feminizing tumor was suspected and corroborated by the Friedman test. At autopsy no gross tumors of the genito-urinary tract were found. It was significant that none of the periaortic lymph nodes which are usually the seat of metastases from testicular teratoma were involved. No tumors were found below the level of the kidneys. That the mediastinal tumor was a teratoma was suggested by the epithelial lined cysts, and it is possible that the teratomatous elements were replaced by the rapidly growing choriocarcinoma.

CONCLUSION

1. A possible case of true extragenital choriocarcinoma occurring in the anterior mediastinum of a male is presented.
2. The probability that the tumor was the remains of a teratoma overgrown by the choriocarcinoma is discussed.

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METHYL SALICYLATE POISONING

A Report of Two Cases and Review of the Literature

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There is voluminous literature on salicylate toxicity. This article deals with methyl salicylate poisoning, a relatively uncommon but tragic occurrence.

To date, there have been 89 reported cases. The first reported were those of Longmore (16) in 1799 when 14 men of the Royal Artillery at Quebec ingested an herb tea containing gualtheria leaves. All of the men recovered, although two were extremely ill with convulsions, dyspnea, unconsciousness, etc. Other early reports were those of Beck (1) (2) in 1838, Gallagher (8) in 1852, Jewett (14) in 1867, and Hamilton (11) in 1875. These last 3 cases were summarized in 1887 by Pinkham (20) who added 1 case of his own. In 1937 Lawson and Kaiser (15) tabulated 43 cases from the literature and added 1 of their own. Stevenson (23), in the same year, gathered 43 cases, 16 of which were not included in Lawson and Kaiser's series and added 3 of his own. This gives us 63 reported cases at that time. In 1943 MacCready (17) tabulated 14 cases, 5 of which were not mentioned by the above authors and 9 occurring since their articles were written. However, 1 of his cases, that of Bowen, Roufa, and Clinger (3) in 1936, was due to anacin and not methyl salicylate intoxication. Adding the 5 cases MacCready reported himself gives us a total of 81 cases. Since this time there have been 8 cases found in the literature. In 1943 Townsend (24) and in 1944 Pelfort (18) each reported 1 case. In 1944 Troll and Menten (25), and Stevens and Kaplan (22) each reported 4 cases of salicylate intoxication. Methyl salicylate was responsible for 1 poisoning in each instance. In the same year, 4 cases,

2 fatal, were reported by Desrochers (6). Including the 2 cases in this report, this gives us a grand total of 91 cases.

The mortality of methyl salicylate poisoning has been found to range from 40 to 60 percent. In this series of 91 cases, there were 41 deaths or a morality of 45 percent. One author points out how lethal oil of wintergreen is as compared to bichloride of mercury poisoning which has a mortality of between 25 and 50 percent.

Forty-five percent of the reported cases have been in infants and children. The young ones usually mistake the minty odor and taste of the drug for candy. Quite often the methyl salicylate is mistaken for cough syrup or a laxative. Occasionally adults imbibe with the thought that the drug has an action similar to that of alcoholic beverages. In European countries there is a proportionately higher incidence of poisoning in adults as this drug is occasionally used for suicidal purposes. One death in a child, attributed to poisoning with methyl salicylate by inunction was found in the literature (15). Not included in the above series was a death reported by Sannicandro (20) due to apparent absorption of salicylic acid from the skin.

Four instances have been found in the literature where infants have died after having as little as 4 to 5 cc. of oil of wintergreen (7) (13) (22) (23). On the other hand, MacCready (17) reported a case of a child who received treatment and survived after taking 30 cc. The smallest fatal adult dose reported was 6 cc. (12). Reports of an adult living after having taken 30 cc. of the drug were not uncommon.

CASE REPORTS

At 1800 on 28 January 1946, two men, M and B, were admitted to our hospital with a history of having had a 120 cc.-bottle of oil of wintergreen to drink 2 hours previously. B had an estimated 90 cc.; M had about 30 cc. M, who was conscious on admission, contributed the history. He stated they drank the fluid "because it tasted good, and they thought there was alcohol in it." Neither patient had vomited.

CASE 1

History and physical examination.—B, who had the larger amount, was said to have become irrational and excited about one-half hour after drinking the oil of wintergreen. Shortly thereafter he fell to the deck unconscious. An hour and a half later he was admitted to the hospital. Physical examination revealed a heavy-set comatose male of 26. He was in a wild delirium, irrational, and showed marked motor activity requiring forcible restraint. His pulse was 140; respiration, 36; blood pressure 140/80. Examination was otherwise negative except for a marked hyperpnea and hyperhidrosis.

Course.—Several attempts at passing a stomach tube were unsuccessful because of the patient's wild mania. Finally a Levin tube was passed to the stomach and an estimated 100 cc. of material, reeking of oil of wintergreen, was aspirated before patient began to retch and vomit. This resulted in patient aspirating some vomitus with resultant respiratory difficulty. Within 10 minutes, patient was laryngoscoped, and suction of material from larynx and trachea was under way. At the completion of this procedure, patient began to convulse

violently. Before adequate measures could be taken, patient threw one final generalized convulsion, and with his chest fixed rigidly in inspiration he became progressively cyanotic and died despite his adequate airway. B's death occurred about 1 hour after he was admitted to the hospital, and 3 hours after he took the poison.

Laboratory.—Blood drawn from the right ventricle of the heart within 15 minutes after patient's death revealed a salicylate level of 186 mg. percent. (Salicylate levels determined by method of Brodie, Underfriend, and Coburn (4).)

Autopsy.—Performed on 31 January 1946, 3 days after death.

A. GROSS

(1) *External appearance.*—Ecchymotic areas of right conjunctiva and diffuse injection of left conjunctiva. Skin about the left side of face, neck, shoulders, and dependent portions bright red in appearance.

(2) *Heart.*—100 cc. of yellow blood-tinged pericardial fluid found. Pericardial surfaces smooth. Small pin-point opening in the middle anterior surface of the right ventricle. The heart weighed 400 grams and was somewhat flabby. Epicardial surface contained numerous discrete hemorrhagic areas up to 2 mm. in diameter. Endocardium and valves normal.

(3) *Lungs.*—Weight 1,195 grams. Each pleural cavity contained 25 cc. of clear yellow fluid. Pleural surfaces were pale red and gray, and contained scattered dark red to black hemorrhagic areas up to 5 mm. in diameter. The lungs were subcrepitant. Cut surfaces were dark red, and on pressure bloody, slightly frothy fluid was expressed. Tracheal and bronchial mucosa dark red. Their lumina were filled with mucoid hemorrhagic fluid.

(4) *Peritoneum.*—Smooth and glistening, containing numerous discrete hemorrhagic areas up to 3 mm. in diameter.

(5) *Gastro-intestinal tract.*—Two dark red hemorrhagic infiltrations, each 1 centimeter in diameter, were found in the mucosa of the stomach. The characteristic odor of oil of wintergreen emanated from the entire bowel.

(6) *Kidneys.*—Weight 340 grams. Each capsule stripped easily revealing a smooth, but somewhat injected surface. Cut surfaces were somewhat pale, and the cortical striations were somewhat prominent.

(7) Spleen, liver, and adrenals showed nothing remarkable.

(8) *Brain.*—Weight, 1,340 grams. Marked congestion of the pia found. The convolutions were slightly flattened and the sulci were somewhat narrowed. The blood vessels of the white matter were very prominent. The middle ears were filled with blood.

B. MICROSCOPIC

Histological examination revealed rather marked postmortem autolysis of the pancreas. There were no noteworthy changes in the heart. There was moderate congestion of the sinusoids of the spleen. The adrenals showed cloudy swelling and fatty degeneration of the zona glomerulosa and reticularis compatible with postmortem change. Except for dilatation of the pial vessels with blood there were no noteworthy changes seen in the brain.

The most marked changes were seen in the kidneys, which showed advanced acute simple necrosis and autolysis, particularly in the convoluted tubules. The epithelium in the collecting tubules was well preserved. The lungs showed moderate congestion of the alveoli. The liver showed slight fatty degeneration. The usual postmortem changes were seen in the trachea, and acute passive congestion was noted in the thymus.

C. ANATOMICAL DIAGNOSIS

1. Methyl salicylate poisoning.
2. Acute hyperemia and edema of the brain.
3. Pulmonary congestion and edema.
4. Multiple petechial and ecchymotic hemorrhages involving the stomach, pericardium, pleura, peritoneum, and conjunctiva.
5. Acute simple necrosis of the kidney tubules.
6. Hemorrhage into the middle ears.

CASE 2

History and physical examination.—M, who had only 30 cc. of oil of winter-green, became weak and dizzy, and began to complain of precordial and generalized abdominal pain about one-half hour after drinking the methyl salicylate. These symptoms persisted up to the time of his admission at 1800. Physical examination revealed an excited and restless, but conscious and well oriented 22-year-old white male. His skin was moist and flushed. Temperature, 99.6; pulse, 130; respirations, 28; and blood pulse, 130/80. Tonsils were enlarged. Pharynx was diffusely reddened. Respirations were increased and of a deep type. Abdominal examination revealed periumbilical tenderness with muscle guarding. Rest of examination was essentially negative.

Course and treatment.—Patient was instructed to drink warm water, and after having taken about 10 glasses was made to vomit. This procedure was repeated once. Following this, a Levin tube was passed to the stomach and an estimated liter of cloudy yellow-brown fluid smelling strongly of oil of winter-green was aspirated. Stomach was then lavaged with 200 cc. of a 10 percent solution of sodium bicarbonate. At this point, patient was still conscious, but seemed somewhat apprehensive. Shortly thereafter, patient's respirations increased to 32 a minute. About an hour after admission (1900) patient had developed a marked hyperpnea, a recurrence of his abdominal pain, and had become restless, irritable, and semicomatose. Shortly thereafter, he had three generalized convulsive seizures. It took $11\frac{1}{4}$ grains of sodium amytal intravenously to quiet patient. (From 1900 to 0100 a total of 30 grains of sodium amytal intravenously were used to keep the patient quiet. Effects of the drug would last 20 to 30 minutes, when patient would again become extremely restless and start to convulse.)

At 1930 oxygen by mask and 1,000 cc. of 5 percent dextrose in normal saline were started intravenously. Temperature was 102.2° F. rectally. At this time, blood which was drawn on admission was reported as showing a salicylate level of 40 mg. percent, Carbon dioxide combining power of 31 vols. percent, and a serum calcium of 8.6 mg. percent. His red blood count was 4.6 million, white blood count 23,350 with 85 percent neutrophils. Urine showed a specific gravity of 1.017; reaction—acid; albumin—75 mg. percent; sugar—trace; white blood cells, 16–18 (high power field). Salicylates were present. (Ferric chloride test.) Salicylate level on concentrated urine 63.5 milligrams percent. Acetone and diacetic acid not done.

The patient's course from the time he started to convulse until 0730 the following morning was a very stormy one. He remained comatose during the entire period. At certain intervals throughout the night various muscle groups were noted to twitch. Trousseau's sign was positive. His temperature, pulse, respiration, and blood pressure remained elevated throughout the night and early morning. At one point his temperature was read at 106.8° F. axillary, and we felt certain that the patient was going to die. The patient was treated symptomatically. As mentioned before, his extreme restlessness and

convulsions were controlled with heroic doses of sodium amytal. This drug seemed to have little effect on patient's respiratory rate. During this period the sodium amytal was augmented by a total of 50 cc. of a 10 percent solution of calcium gluconate given at intervals in 10 cc. doses. A total of 3,000 cc. of fluid were given by vein in a 6½-hour period. 2,000 cc. consisted of 5 percent dextrose in saline. At 2300, CO₂ combining power was 40 vols. percent, and 1,000 cc. of M/6 sodium lactate was given by vein. Patient's temperature was kept down by alcohol sponges, ice bags, and by wrapping him in wet sheets.

About 0730 (29 January 1946) the patient began to show improvement. His temperature, pulse, and respiration began to drop. Patient could open his eyes on command and answer questions by nodding his head.

At 0930 patient started speaking, recognized people, and seemed to be oriented. He complained of dimness of vision and difficulty in hearing. Physical examination revealed marked hyperhidrosis, urinary incontinence, and a moderate decrease in visual and auditory functions as judged by gross tests. He had a mild diarrhea and a strong odor of oil of wintergreen was noted in his stools. His blood pressure was down to 88/60 and his pulse felt weaker. Patient was given ephedrine sulfate grain ¾ intramuscularly. (Pulse became stronger, but blood pressure remained around 90/60 until about 1100 after 250 cc. of plasma had been given.) Blood drawn at 0700 was reported as showing a salicylate level of 125 mg. percent, a serum calcium of 6.7 mg. percent, a carbon dioxide combining power of 31 vol. percent, and a blood urea nitrogen of 27.4 mg. percent. The urine was alkaline with a specific gravity of 1.017, 4 plus albumin, and a 4 plus occult blood. Microscopic examination showed many white blood cells and red blood cells per high power field. There was a trace of sugar. Unfortunately, no diacetic acid or acetone was done.

From this time on patient began to improve rapidly. He was put on sodium bicarbonate 30 grains four times a day, and fluids were pushed by mouth.

The following day (30 January 1946) patient still complained of poor hearing. He stated that his vision had improved somewhat. His speech was thick and on questioning, patient stated he was aware of this. Latter phenomenon lasted for only a day. Patient also complained of a sore throat. Physical examination revealed a temperature of 102° F., a markedly inflamed pharynx and tonsils, and bronchial breathing with subcrepitant râles over right lower lobe. Penicillin 20,000 units, every 3 hours, was started. Under this regimen his urinary incontinence and pneumonic process quickly subsided after several days.

Laboratory work on this day revealed a blood carbon dioxide combining power of 52 vol. percent; blood urea nitrogen, 54; nonprotein nitrogen 75; and creatinine, 4.9 mg. percent. The blood salicylate level was 56.2 mg. percent. Serum calcium 8.8 mg. percent. White blood cells, 7,000 with 78 percent neutrophils.

On 2 February 1946 it was noted that the patient's respirations had finally come down to 18 a minute and were regular. His urine showed 4 plus albumin, 1 plus sugar with 4 to 5 white blood cells and red blood cells per high power field, and many epithelial cells. Urine continued to show these findings and the azotemia persisted. On 9 February 1946 a 3-hour P. S. P. test showed only 20 percent excretion the first hour, 25 percent the second hour, and 15 percent the third hour.

On 11 February 1946 a concentration-dilution test showed a range of from 1.005 to 1.026. The urinalysis on this date was entirely negative as were subsequent tests. The nonprotein nitrogen had come down to 28.5 mg. percent and the blood urea nitrogen was down to 14 mg. percent. On this date, 14 days after

admission, the patient's hearing and sight were back to normal. The patient had been up and around for a week and remained asymptomatic until his discharge from the hospital on 22 February 1946.

DISCUSSION

No attempt will be made in this article to discuss the mechanism of salicylate intoxication. There is voluminous material on this subject in the literature. At present, there are many conflicting views as to its pathogenesis, and the exact mechanism of salicylate intoxication is still a baffling problem. We would just like to mention five main schools of thought in regard to the prime physiopathological changes that occur. These are:

(1) Severe acidosis which leads to hyperpnea.

(2) Direct stimulation of the respiratory center, which first produces an alkalosis, but which terminates in acidosis.

(Although our patient, M, had a CO₂ combining power of 31 vols. percent on blood drawn on admission, as well as clinical signs of acidosis, it would be difficult to explain his severe hyperpnea by the acidosis mechanism alone. Most patients in severe diabetic acidosis never show the terrific hyperpnea that was seen in these cases.)

(3) A direct increase in the basal metabolic rate.

(4) Increase in the prothrombin time. (This mechanism may serve to partly explain the generalized serosal petechial hemorrhages found at autopsy on B. However, it is impossible to draw any conclusions because of lack of adequate blood studies.)

(5) Methyl salicylate is broken down into its component parts and methyl alcohol is responsible for the toxicity.

Although clinical and laboratory evidence gathered in these cases is far from conclusive in supporting any one view, we believe that the first four of these theories all play some role in the picture. The last postulation probably plays no role in the pathogenesis of salicylate intoxication.

COMMENT

Several points in these two cases are worth noting. First of all, it should be stressed that methyl salicylate is a very potent and lethal drug which acts fairly rapidly. This point has been emphasized in previous articles (17) (23). One should remember that as little as 4 cc. has killed a child and 6 cc. an adult. Symptoms occurred in the present cases one-half hour after the poison was ingested, and B's death occurred 3 hours after having approximately 90 cc. of the methyl salicylate. In reviewing the literature, the majority of the cases reported did not show such a rapid action of the poison.

The main problem in the treatment of M was controlling his violent convulsions and wild mania. It is interesting to note the heroic doses

of sodium amytal that were used (a total of 2 grams in 6 hours) without any immediate or delayed toxic effect. Perhaps, if similar heroic dosage had been carried out promptly in the case of B his life might have been spared also. The convulsions and clinical picture of tetany in M's case could probably be explained, in part, on the basis of a low blood calcium. The laboratory reported a level of 6.7 milligrams percent the following morning, after a total of 50 cc. of a 10 percent solution of calcium gluconate had been given him the night before. One might explain the lowered blood calcium on the basis of impaired renal function. There was certainly sufficient evidence of it in the blood and urine of M. (Incidentally no permanent renal damage could be demonstrated in this patient at the time of his discharge from the hospital.) Further evidence of renal impairment is found in the work done by Pincus and Handley (19). These authors demonstrated a definite phosphate, chloride, urea, and nonprotein nitrogen retention in salicylism.

Two other problems in the treatment of this case were the patient's high temperature and the development of pneumonia. The former was handled in a routine manner. However, when his temperature began to hover around 106° F., more radical measures such as placing patient between cold wet sheets, had to be resorted to. The pneumonia responded to penicillin therapy quite rapidly.

Finally, it is of interest that the patient who died had a blood salicylate level of 186 milligrams percent and that the highest salicylate level recorded in the patient who survived was 125 milligrams percent. We were unable to find such high blood levels in the literature. Stevens and Kaplan (22) reported a case in which the blood salicylate level was 100.4 milligrams percent. According to most authorities, toxic manifestations of the drug begin to occur at levels of 40 to 50 milligrams percent. In the work done by Coombs et al. (5), evidence was obtained which indicates that toxic reactions occur when blood salicylate levels are maintained over 30 milligrams percent.

Another interesting point in regard to the treatment of M was that in spite of apparently adequate emesis and lavage, there was sufficient evidence to show that methyl salicylate was still being absorbed from the gastro-intestinal tract following the procedure. M's salicylate level on blood drawn on admission was only 40 milligrams percent. The following morning the blood salicylate level was 125 milligrams percent. There was also a very strong odor of oil of wintergreen in the patient's stools that morning. MacCready (17) suggests that one should lavage the stomach until the odor of oil of wintergreen is no longer apparent in the washings. Goodman and Gillman (9) state that the absorption of salicylates from the gastro-intestinal tract may be delayed many hours, and therefore gastric lavage should be per-

formed in cases of poisoning even though they are seen late. These authors also suggest the use of a rapidly acting cathartic to move the unabsorbed salicylate through the remainder of the bowel as rapidly as possible.

SUMMARY AND CONCLUSIONS

Two cases of acute methyl salicylate poisoning along with a brief review of the literature were presented. In the fatal case, complete findings on post-mortem examination were tabulated. These were similar to those reported in previous cases.

No attempt was made to discuss the pathogenesis and physiopathology of this condition other than to mention some of the more important theories along with a few comments and personal opinions.

A few problems in the treatment of this condition were discussed. To reiterate these were: convulsions, high fever, and pneumonia. Intelligent treatment depends on an understanding of the physiochemical changes that take place. Until the conflicting views in this regard are settled, one should treat the patient symptomatically following the chemical changes in the blood and urine as well as possible and treating accordingly. There is clinical evidence to warrant (and experimental evidence to substantiate) the use of sodium bicarbonate, intravenous fluids (dextrose, saline, and lactate), vitamin K, calcium gluconate, and sedatives in the treatment of salicylate intoxication.

We would again like to emphasize that methyl salicylate is a very potent and fairly rapid acting poison. Bottles containing this drug should be clearly labeled "POISON" and should be kept from the reach of children.

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MEDICAL AND SURGICAL DEVICES



PRESERVATION OF MUSEUM SPECIMENS IN PLEXIGLAS

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A method for the preservation of pathological specimens for the museum has been developed at the United States Naval Hospital at Corona, Calif., which has advantages over the method of preservation in glass jars.

Plexiglas is used instead of glass jars. The Plexiglas may be cut to form containers of any size, and if desired, may be bent to form curved surfaces, although when a curved or cylindrical container is used the magnification enlarges and distorts the image of the specimen. All specimens at this hospital are being enclosed in flat-surface containers with excellent results.

It is first necessary to determine the dimensions of the desired container and the Plexiglas is cut accordingly. Plexiglas is soluble in glacial acetic acid, and this is used to seal the edges together. A small amount of Plexiglas should be dissolved in the acid making a plastic cement before the acid is applied to the edges for sealing. This makes watertight sealing of the edges easier. A clamp is desirable to hold the two edges together as they are being sealed. The acetic acid with a small amount of Plexiglas dissolved in it is applied with a small hypodermic needle and a 2-cc. syringe. The needle is drawn along the line of contact of the two edges while a small amount of the acid is expelled from the syringe. The acid can be seen to flow quickly between the two surfaces and fusion takes place in 2 or 3 minutes. The syringe should be cleaned with a small amount of glacial acetic acid that has no Plexiglas dissolved in it after it is used to prevent sticking. It is desirable that the Plexiglas be cut as true as possible so the edges fit evenly before attempted assimilation—this, with the addition of clamps when the acid is applied, will save time and labor as it makes practically all seams watertight immediately. A good joint is indicated by the absence of air bubbles between the two pieces.

The specimen may be mounted securely in the Plexiglas container by drilling holes through small squares of Plexiglas which are then attached to the inside surfaces of the container where desired for support of the specimen. The squares are quickly secured by a small amount of the acetic acid as soon as they are in place. Small wires can then be threaded through the holes and attached to the specimen to support it. We have found dental ligature wire, size 0.02 inch satisfactory for this purpose.

After the specimen is secured in the container in the desired position, the preservative (Kaiserling's solution or formalin) is poured into the container and the remaining side is put in position, clamped, and glacial acetic acid is then applied along the seam. The clamps may be removed in 10 minutes with safety.

A small hole is then drilled in one of the smaller surfaces about one-fourth inch from a corner for the purpose of completely filling the container with the preservative. This is easily accomplished by a small electric hand drill. The preservative fluid may be added by a needle and syringe. In this manner the container is completely filled and the hole is plugged with a small piece of Plexiglas and acetic acid.



FIGURE 1.

The case number of the specimen, and the diagnosis is typewritten and attached to the outside of the container with scotch tape.

We have been able to obtain the Plexiglas from the occupational therapy department at this hospital.

Specimens mounted as described are lighter in weight than those preserved in glass jars. The container can be made to fit the size of the specimen. Supports can be placed as needed to maintain the specimen in any position. They can be viewed clearly and without distortion and the general appearance is much more attractive than jars sealed with cement. The container is permanently leakproof once it is sealed and needs no further attention.



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UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
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(For review)

OCCUPATIONAL DISEASES OF THE SKIN, by Louis Schwartz, M. D., *Medical Director, United States Public Health Service, Chief Dermatoses Section, Associated Clinical Professor of Dermatology and Syphilology, New York University, Adjunct Professor of Dermatology and Syphilology, Georgetown University*; Louis Tullipan, M. D., *Clinical Professor of Dermatology and Syphilology, New York University, College of Medicine, New York City, Consulting Dermatologist, Manhattan General Hospital, Associate Visiting Dermatologist and Syphilologist to Bellevue Hospital*; and Samuel M. Peck, B. S., M. D., *Dermatologist, Mt. Sinai Hospital, New York City, Medical Director, Inactive (R) U. S. P. H. S.* 2d edition. 964 pages; 146 illustrations and a color plate. Lea & Febiger, Philadelphia, Pa., publishers, 1947. Price \$12.50.

This is a welcome second edition of a well-known text dealing with the manifold dermatological problems encountered in industry. The book is authoritative and quite inclusive, presenting an abundance of data on every aspect of the relationship of various occupations and associated dermatoses.

The material is arranged by trades, occupations, and professions as well as by etiologic agents. Preventive, investigative, and therapeutic facets of the management of skin diseases due to the hazards of industry are fully stressed. The medico-legal and historical chapters make for completeness and additional interest. A complete list of chemicals known to be skin irritants is included. The material is presented throughout in a clear, concise style.

In this second edition there are described the cutaneous disorders incident to the more recent development of the newer chemicals and industrial processes during the war years. Certain chapters dealing with the dermatoses due to mechanical and physical agents, to explosives, to war gases, etc., will prove of special interest to those

medical officers who are called upon to diagnose and treat skin ailments among those who work in such specialized fields.

The format of the book is pleasing, but a number of the photographic illustrations are lacking in acuity and do not show the details of gross skin pathology as well as might be desired.

INSECT MICROBIOLOGY, by Edward A. Steinhaus, *Assistant Professor of Bacteriology and Assistant Insect Pathologist in the Agricultural Experiment Station at the University of California, Berkeley, formerly Associate Bacteriologist at the Rocky Mountain Laboratory, U. S. Public Health Service.* 763 pages; numerous illustrations. Comstock Publishing Co., Inc., Ithaca, N. Y., publishers, 1946. Price \$7.75.

This book is rightly described in the preface as "an attempt to treat the various associations and relationships existing between all types of microbes and insects (including ticks and mites) from a biologic standpoint, and, in a sense, to serve as a compendium of the data concerned." Biologic relationships existing between pathogenic agents and their arthropod hosts and vectors are included as well as those between nonpathogenic agents and insects and ticks in general. No attempt was made to treat any particular field of microbiology, as the fundamentals of bacteriology, protozoology, and other related fields are not included. Each group of microbes has been treated with reference to its association with insects. This volume would serve well as reference material for scientists interested in such fields as medical entomology, physiology of insects, insect pathology, plant pathology, bacteriology, or parasitology.

The majority of modern treatises on insect microbiology deal with pathogenic organisms of importance in medical and veterinary sciences, while the general biologic relationships between microbes and insects, the processes and adaptations involved, their effect upon the respective ecologies and biologies, are not adequately treated. A knowledge of the phenomena of biologic relationships of both pathogenic and nonpathogenic forms to their hosts would be valuable in the correct interpretation of future research on the subject. Professor Steinhaus defines the purpose of the entire book as an introduction to the field, embracing the microbiology of insects, to those whom it may concern.

The first part of the book is concerned with bacteria and insects, treating the extracellular bacteria found on the external surfaces, in the alimentary tract, blood, and cecae. The fate of bacteria during metamorphosis, transmission from generation to generation and their role in the nutrition of insects is discussed at length. The bacteria associated extracellularly with insects and ticks are systematically catalogued. Over 300 specific names of the bacteria which have been associated with insects and ticks are listed together with the names of arthropods with which the bacterium in question is associated and an

abstract or synopsis of the nature of its arthropod relationship. This information covers three chapters and 187 pages.

Sixty-eight pages are devoted to a discussion of intracellular bacteriumlike and Rickettsialike symbiotes. Intracellular microorganisms are so far known to occur in approximately a dozen orders of insects and in the ticks and mites. The nature of intracellular symbiotes, their presence in the mycetoms of insects, and their role or function is considered in some detail. Selected examples of micro-symbiotes are arranged according to their arthropod hosts.

The remainder of the book, a total of 340 pages is devoted to discussions on Rickettsiae, yeasts, fungi, viruses, spirochetes, and protozoa, with chapters on immunity in insects and methods and procedures. Pathogenic and nonpathogenic Rickettsiae are included together with their biologic relationships, and morphology. The yeasts and yeast-like organisms are separated as to whether they occur extracellularly or intracellularly with respect to their host's tissues. The biologic relationships existing between the various groups of fungi and their insect hosts are treated under the four main classes of fungi. The various fungi causing diseases in insects are treated very fully. The relationships between insects and viruses are divided into (1) the virus diseases of insects (2) biologic relationships between arthropods and viruses causing diseases of animals and plants, and (3) bacteriophage. The relapsing fever group of spirochetes is discussed together with other spirochetes associated with ticks and insects and causing diseases of vertebrates. The phylum protozoa is discussed by classes under the subphyla with reference to insect relationship. The termites are treated separately. Immunity in insects is considered as natural and acquired. The two types of immunity discussed are cellular and humoral.

The last chapter of the book is concerned with methods and procedures for investigating the various microbes associated with insects and ticks and includes collecting and handling, dissection, and microbiologic examination. This chapter should be an aid to scientists interested in such techniques.

This volume is a stepping stone in the field of insect microbiology. It is an attempt to organize available knowledge on the subject which, for the most part, has been widely scattered in literature. The author has handled the material in an excellent manner, and the book merits a place on reference shelves for the convenience of students and research workers in this field.

THE COMPLETE PEDIATRICIAN, by Wilburt C. Davison, M. A., D. Sc., M. D., *Professor of Pediatrics, Duke University School of Medicine, and Pediatrician, Duke Hospital, formerly Acting Head of Department of Pediatrics, The Johns Hopkins University School of Medicine, Acting Pediatrician in Charge, The Johns Hopkins Hospital, and Member American Board of*

Pediatrics, Fellow American Academy of Pediatrics and American College of Physicians, Member American Pediatric Society, and Division of Medical Sciences, National Research Council. 5th edition. Duke University Press, Durham, N. C., publishers, 1946. Price \$3.75.

This fifth edition of a well-known book has been completely rewritten and brought up to date, particularly in the field of chemotherapy, and infectious and tropical diseases.

The section on growth and development has been enlarged considerably as experience has shown that knowledge of this subject is essential to adequate pediatric care. The section on laboratory and other procedures is especially useful as a handy reference for the busy physician.

The book has many cross references which may be confusing to the casual reader, and in order to obtain the maximum use of the text, instructions for its use should be read and followed.

The Compleat Pediatrician is designed not to be used as or to take the place of a textbook, but rather as a handy reference for students, interns, general practitioners, and pediatricians. When used in conjunction with standard texts and current literature, it is an exceedingly helpful text to have at one's fingertips.

It is highly recommended not only for pediatricians but for all physicians who are called upon to diagnose and treat the diseases of infants and children.

METHODS OF DIAGNOSIS, by Logan Clendening, M. D., F. A. C. P., *Late Professor of Clinical Medicine and History of Medicine, University of Kansas School of Medicine*, and Edward H. Hashinger, M. D., F. A. C. P., *Professor of Clinical Medicine, University of Kansas School of Medicine*. 868 pages; 143 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1947. Price \$12.50.

This book on diagnosis approaches the subject from the standpoint of the three essential fact-finding sources for a diagnosis. These are, of course, the patients' own story, the physical examination, and the laboratory reports and clinical observation. In two excellent preliminary chapters are studies of the general principles back of all diagnostic reasoning.

The various anatomic parts and systems are then taken up in order. Following are résumés of laboratory and special procedures. In the latter there is a section on x-ray, one on the electrocardiogram, basal metabolism, ophthalmoscopy, proctoscopy, and also peritoneoscopy. In illustrating the book the diagrammatic type of picture has been used extensively and very effectively.

All who know Dr. Clendening's literary abilities will recognize much that makes this different than other textbooks on this subject. It is nearer to excellence in interest and literary style than probably any other American work with the exception of Cabot. The principal

critical comment is that more space might have been given to the interpretation of some laboratory results and caution in regard to the more radical diagnostic procedures.

TEXTBOOK OF BIOCHEMISTRY, by Benjamin Harrow, Ph. D., *Professor of Chemistry, College of City of New York*. 4th edition. 592 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price, \$4.25.

Since the knowledge of biochemistry is constantly advancing, the new revised edition of this book is desirable. Many of the recent advances in such topics as transamination, transmethylation, thiouracil in hyperthyroidism, alloxan diabetes, glutamic acid in epilepsy, and streptomycin are given. In addition to the many minor improvements made throughout the book, the many changes are summarized in the preface to the fourth edition. This would allow a busy practitioner to review recent advances with a minimum of effort.

In general the topics treated are too brief, and they are especially meager in regard to clinical applications. The paucity of clinical investigations and correlations is not to be taken as adverse criticism since the new edition is an improvement over the earlier editions. Immunochemistry and chemotherapy are inadequately treated both from subject-matter and clinical applications. A few typographical errors exist, but fortunately they are rare.

The references at the end of the chapters are excellent. These references are further grouped to a specific subject under study. These make a specialty of reviews rather than of individual original papers. The text could be materially improved by incorporating more of the data from these reviews, since, in many cases, the reader would be unable to avail himself of these journals.

The fourth edition has many good points to recommend it. No one could accuse the author of not being concise in treatment of any of the subjects. The chapters on vitamins and hormones are well illustrated with pictures of animals or humans displaying the clinical signs of the malady at hand. Excellent are the chapters dealing with the metabolism of the carbohydrates, fats, and proteins as well as biological oxidations.

The new edition can be used profitably by physicians who are desirous of keeping abreast of the advancing field of biochemistry and are able to integrate this knowledge with their clinical applications. The application of therapeutic procedures to diseases often parallels the advances made in biochemistry.

PRACTICAL PEDODONTIA OR JUVENILE OPERATIVE DENTISTRY AND PUBLIC HEALTH DENTISTRY, An Introductory Text for Students and Practitioners of Dentistry, by Floyd Eddy Hogeboom, D. D. S., F. A. C. D., *Professor of Children's Dentistry, College of Dentistry, University of Southern California, former Member Health and Development Department, Pasadena City*

Schools, former Member of Children's Hospital Staff, Los Angeles, Chairman, Dental Assistant's Course, Los Angeles Junior College, Los Angeles 1930-37; Special chapters by Forrest Anderson, M. D., Sc. D. (Med.), Director, Child Guidance Clinic of Los Angeles and Pasadena, lecturer in Mental Hygiene, University of California, and College of Dentistry, University of Southern California; Harold Hawkins, D. D. S., Former Associate Professor of Bacteriology and Preventive Dentistry, College of Dentistry, University of Southern California; Thaddeus P. Hyatt, D. D. S., F. A. C. D., Former Professor of Preventive Dentistry, New York University, College of Dentistry, former Director, Dental Department, Metropolitan Life Insurance Co.; and Harry E. Straub, D. D. S., Special Instructor in Exodontia and Minor Surgery, former faculty member College of Dentistry, University of Southern California. 5th edition. 503 pages; numerous illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1946. Price \$8.50.

This book on practical pedodontia or juvenile dentistry is the fifth edition by the same author. It is my opinion that this edition covers the field of dentistry for children more thoroughly than any other edition or text on the subject; by incorporating four chapters in this edition by outstanding men in the various fields of development, growth, nutrition, and preventive orthodontics. It can be said that this text covers the most important phases relative to dentistry for children from the very onset of pregnancy to the young adult.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



TOXIC REACTIONS IN THE TREATMENT OF SYPHILIS IN THE UNITED STATES NAVY IN 1946

Since 1925 medical officers of the Navy have been required to submit an annual report showing the number of persons who have or have had a history of syphilis, the number of these persons treated during the calendar year with arsenicals, and since 1945 the number of courses of penicillin administered in the treatment of syphilis. A separate report of each case in which a reaction occurs is also required.

As of 31 December 1946 there were 11,214 individuals in the Navy and Marine Corps on the syphilis census (those individuals who have syphilis or have had a history of syphilis sometime during their naval career). This census does not include those persons who were separated from the service during the year. Of these 11,214 persons, 1,589, or 14.2 percent, were Negroes and 9,625, or 85.8 percent, were all other naval personnel. When the two categories of naval personnel are considered separately, 7.2 percent of the Negro personnel and 1.5 percent of all other personnel had a history of syphilis on 31 December 1946.

Of the 11,214 individuals on the syphilis census on 31 December 1946, 3,240 were treated during the year. In addition to these 3,240 active-duty patients treated during 1946, there were 135 patients classed as "other personnel" who received treatment. "Other personnel" includes Veterans' Administration patients, dependents of naval personnel, civilian workers, and native populations of insular possessions and islands of the Pacific under naval jurisdiction.

Detailed data regarding the treatment of the active-duty Navy and Marine Corps personnel are set forth in table 1. It may be noted that the overwhelming majority of the cases, 76.2 percent, were treated with penicillin and some received both arsenicals and penicillin. This is consistent with the recommended schedule of treating syphilis cases as follows:

(a) *Primary seronegative*: 60 intramuscular injections of penicillin, 100,000 units each, every 3 hours day and night for 7½ days—total dosage 6 million units.

(b) *Primary seropositive*: secondary and latent; 80 injections of penicillin, 100,000 units each, every 3 hours day and night for 10 days—total dosage 8 million units.

(c) *First relapse or reinfection of previously treated syphilis cases*: 80 intramuscular injections of penicillin, 100,000 units each, every 3 hours day and night for 10 days—total dosage 8 million units. Concurrent intravenous injections of mapharsen 60 mg. (0.06 gram) each twice weekly for 5 weeks—total dosage 600 mg. and intramuscular injections of bismuth subsalicylate in oil 1½ cc. (200 mg.) (expressed as subsalicylate not as bismuth metal) each week for 5 weeks—total dosage 1,000 mg.

(d) *Second relapse of previously treated syphilis cases*: 26 weeks' mapharsen-bismuth schedule. This consists of 10 weeks of mapharsen injections given twice a week followed by 6 weeks of bismuth given once a week and another 10 weeks of mapharsen given twice a week. During the first 5 weeks and during the final 5 weeks of treatment, bismuth and mapharsen are given concurrently once a week. Dosage of mapharsen should be approximately 1 mg. per kg. of body weight; minimum single dose, 50 mg. and maximum single dose, 70 mg. Dosage of bismuth subsalicylate in oil is 1½ cc. (200 mg.) (expressed as subsalicylate not as bismuth metal).

TABLE 1.—*Personnel,¹ Navy and Marine Corps, treated for syphilis with arsenicals and penicillin, 1946*

Drug	Persons treated			
	Negro	All other	Total	
			Number	Percent
Arsenicals	195	576	771	23.8
Bismarsen.....	1	3	4	.1
Mapharsen.....	188	558	746	23.1
Neoarsphenamine.....	5	12	17	.5
Tryparsamide.....	1	3	4	.1
Penicillin	674	1,795	2,469	76.2
Total.....	869	2,371	3,240	100.0

¹ Does not include 135 "other personnel."

During the 22-year period 1925 through 1946, the period in which data on the arsenical treatment of syphilis have been compiled, 2,681,148 doses of arsenicals have been administered. Reactions to these drugs have been reported in 1,325 cases.

A dose of an arsenical is defined as a single injection of the drug (in the case of mapharsen either 0.045 or 0.06 gram).

The notable factor in the arsenical treatment of syphilis in 1946 has been the relative freedom from toxic reactions, only two mild reactions having been reported. It is probable, of course, that some extremely mild reactions may have been either overlooked or considered too minor to be recorded, but since this condition was applicable during the entire reporting period no confusion should result in attempting to compare data for 1946 with that for previous years. There were no deaths or severe reactions following administration of arsenicals in 1946. Case histories of the two mild reactions (one arsenical dermatitis and one reaction of minor importance) occurring in 1946 are included in this article.

TABLE 2.—*Treatment of syphilis with arsenicals, Navy and Marine Corps, 1946 and 1925-46 combined*

Drug	Number of doses administered	Reactions				Ratio of reactions to doses, 1 to—	Ratio of deaths to doses, 1 to—
		Total	Mild	Severe	Fatal		
1946:							
Bismarsen	187						
Mapharsen	12,919	2	2			6,460	
Neocarphenamine	462						
Tryparsamide	108						
Total	13,676	2	2			6,838	
1925-46 combined:							
Acetarsones ¹	1,013	1	1			1,013	
Arsphenamine	41,558	42	27	14	1	989	41,558
Bismarsen ²	4,999						
Mapharsen ³	1,128,792	213	131	75	7	5,299	161,256
Neocarphenamine	1,395,330	1,038	649	334	55	1,344	25,370
Silver arsphenamine ⁴	607	2		1	1	303	607
Sulfarsphenamine	31,109	25	17	8		1,244	
Tryparsamide	77,740	4	3			19,435	
Total	2,681,148	1,325	828	433	64	2,024	41,893

¹ First administered during the year 1932.

² First administered during the year 1929.

³ First administered during the year 1935.

⁴ First administered during the year 1931.

In table 2 is shown the number of doses of each type of arsenical administered, together with the number and type of reaction, for 1946 and for the combined period 1925 through 1946. The favorable picture for 1946 may be noted in the ratio of reactions to doses, there being only 1 reaction to every 6,838 injections of arsenicals.

As may be observed in figure 1, the general trend in the percent of reactions to arsenicals in the period 1925 through 1946 has been downward, with a drop to the lowest point in 1946. Better treatment technique and the greater use of mapharsen instead of the more toxic arsenicals are undoubtedly responsible in great measure for this decrease.

In the 22-year period there was a reaction rate of 49.4 per 100,000 doses. Of the total reactions, 62.5 percent were mild, 32.7 percent were severe and 4.8 percent were fatal. The type of reaction reported is shown graphically in figure 2. Arsenical dermatitis and vasomotor

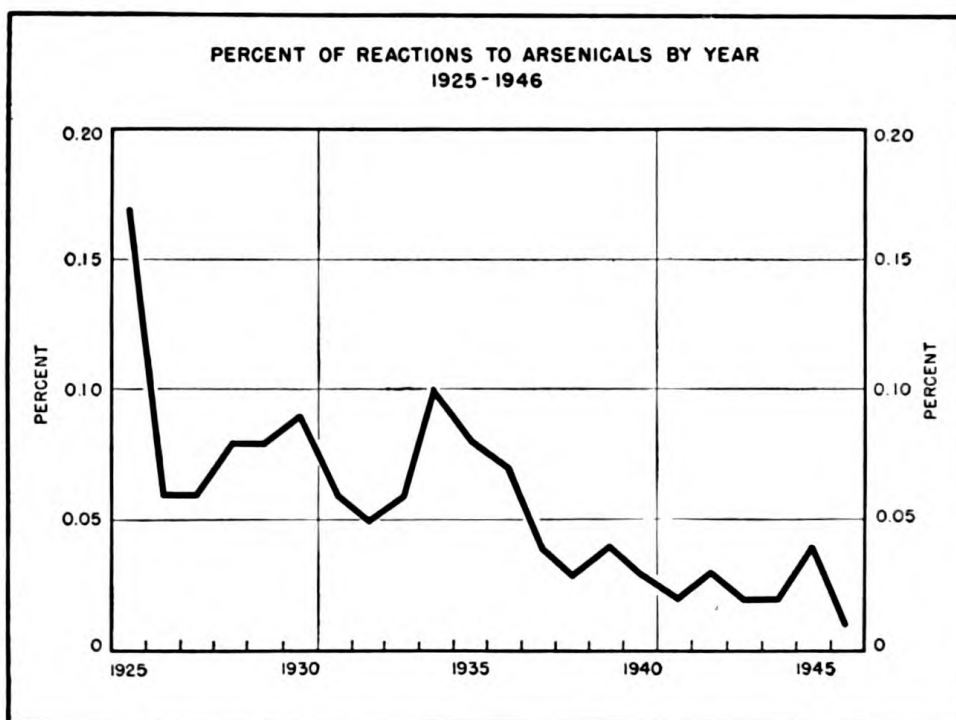


FIGURE 1.

**DISTRIBUTION OF REACTIONS TO ARSENICALS BY TYPE
1929 - 1946 COMBINED**

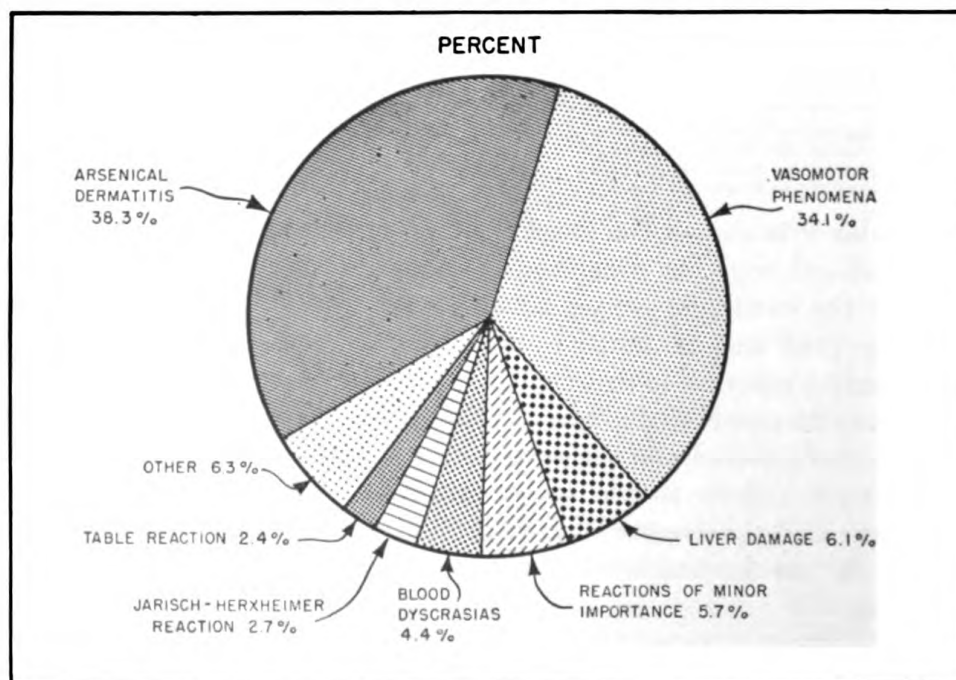


FIGURE 2.

phenomena combined account for 72.4 percent of all the reactions. Among the "other" reactions reported are included gastro-intestinal disturbances, arsenical hypersensitivity, hemorrhagic encephalitis, acute renal damage, arsenical neuritis, optic neuritis, toxic encephalopathy, vascular damage, borderline hemorrhagic encephalitis, fever, circulatory collapse, and polyneuritis.

The recent expanded use of penicillin in the treatment of syphilis has warranted additional discussion of this phase of antiluetic therapy. In 1945 the recommended dosage of penicillin was 2,400,000 units for

**DISTRIBUTION OF PENICILLIN ADMINISTERED IN TREATMENT OF SYPHILIS
BY NUMBER OF UNITS IN COURSE
1946**

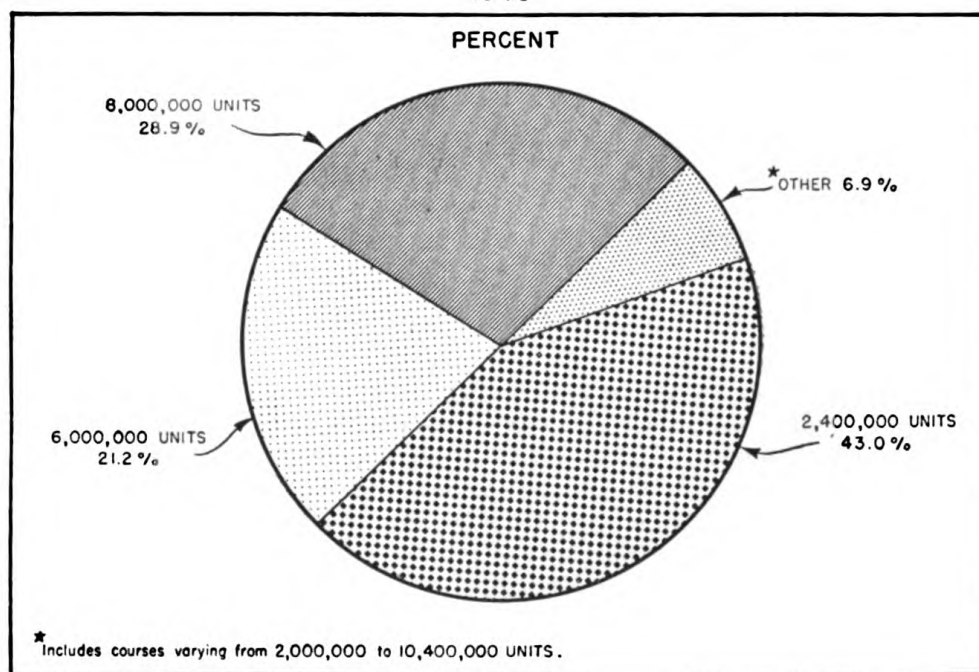


FIGURE 3.

each course for both early and latent syphilis. In June 1946 the recommended dosage was increased to either 6,000,000 units or 8,000,000 units for each course. As may be noted in table 3 and in figure 3, the 2,400,000 unit course was used in 43.0 percent of the cases in 1946. There was a range in individual courses, however, from 2,000,000 units to 10,400,000 units. The total number of courses administered to naval personnel was 4,106 with an additional 214 courses administered to "other personnel." Serious clinical reactions to penicillin are rare. No deaths attributable to the drug have been reported.

TABLE 3.—*Penicillin administered in treatment of syphilis,¹ Navy and Marine Corps, 1946*

Number of units in course	Courses administered			
	Negro	All other	Total	
			Number	Percent
2,400,000.....	509	1,257	1,766	43.0
6,000,000.....	347	523	870	21.2
8,000,000.....	528	659	1,187	28.9
Other ²	54	229	283	6.9
Total.....	1,438	2,668	4,106	100.0

¹ Does not include 214 courses administered to "other personnel."² Includes courses varying from 2,000,000 to 10,400,000 units.

This discussion has been limited to the types of treatment for syphilis and the toxic reactions reported therefrom. No attempt has been made to evaluate the relative merits of penicillin and arsenicals in the treatment of syphilis.

ARSENICAL DERMATITIS

Only one arsenical dermatitis reaction was reported in 1946. This reaction occurred after the fourth injection of mapharsen. The patient, however, had experienced nausea and vomiting after the third injection.

Case 1.—This patient was exposed to infection on 25 September 1946 and on 9 October 1946 a shallow ulcer appeared on the shaft of penis. This lesion was slightly indurated, nonpainful, and its margins were clearly marked. There was an associated slight inguinal adenopathy. Darkfield examinations on 10 and 11 October 1946 were positive for *Treponema pallidum*. Blood Kahn examinations repeated monthly; patient seronegative to date.

The patient received 2,500,000 units of penicillin over a period of 8 days. The 26-week antiluetic treatment was begun on 21 October 1946, when 0.045 gram of mapharsen and 0.13 gram of bismuth were administered. The patient received 0.06 gram mapharsen on 23 October and 0.06 gram mapharsen and 0.13 gram bismuth on 28 October. Nausea and vomiting occurred 2 hours after these injections. On 31 October the patient received 0.06 gram mapharsen, following which a small patch of eczematous type of dermatitis appeared over right median epicondyle. Treatment continued and he received four 0.06-gram injections of mapharsen and two 0.13-gram injections of bismuth between 4 and 15 November. Since the areas of dermatitis had spread over the shoulders and small patches were on the hip treatment was discontinued and the patient was referred to the dermatology department of a naval hospital for consultation. The consultants were of the opinion that the rash was due to a contact dermatitis, but due to the fact that an arsenical dermatitis could not be ruled out it was considered advisable to discontinue all treatment.

Antileuetic treatment was discontinued. A change of soap and less frequent baths were ordered for the patient and the rash disappeared after a period of 2 weeks. No laboratory work was completed.

It appears extremely doubtful that the dermatitis in this case was due to the administration of an arsenical; however, since an arsenical dermatitis could not be ruled out it has been included.

REACTIONS OF MINOR IMPORTANCE

Case 2.—This patient was exposed to infection on 18 November 1945 and on 3 December 1945 an indurated, raised lesion appeared on dorsum of penis just proximal to the corona. This lesion was not ulcerated or tender. Small ulcers were also present, one near the frenulum and the other on the dorsum near the corona. Darkfields from both lesions revealed organisms typical of *Treponema pallidum*.

The patient received 2,400,000 units of penicillin divided into 60 doses, every 3 hours from 3 to 10 December 1945. Blood was Kolmer-positive on 18 December and the patient was started on mapharsen treatment on 21 December, 0.04 gram being administered. Twice weekly injections of 0.06 gram mapharsen and weekly injections of 0.2 gram bismuth were given thereafter. After the fourth injection of mapharsen the patient noted slight nausea. Emesis followed the injection on 1 January 1946 and treatment was discontinued. The patient had received a total of 0.28 gram mapharsen and 0.6 gram bismuth.

The patient complained of frontal headache and pain on palpation of muscles of extremities. Laboratory examination: white blood cells, 12,800; polymorphonuclears, 80 percent; no toxic forms, lymphocytes, 29; hemoglobin, 14.4 percent; urine: amber, alkaline, no sugar, no albumen; microscopic: 3-4 red cells per highpower field; stool; no gross blood.

Treatment: 1,000 cc. 5 percent solution of dextrose in 0.9 percent saline given slowly intravenously. On 2 January 1946 the patient was comfortable. Laboratory: white blood cells, 12,800; segmented cells, 80 percent; lymphocytes, 20 percent; urine, 4-5 red cells per highpower field. On 3 January patient complained of frontal headache only.

Uneventful recovery in 8 days.

The drug of the lot number which caused this reaction had been successfully used in some 50 previous treatments with no untoward reaction.

Previous articles dealing with the toxic effects of arsenical compounds have been published in the following issues of the U. S. NAVAL MEDICAL BULLETIN:

September 1925.	January 1935.	October 1939.	January 1944.
January 1927.	October 1935.	January 1940.	October 1944.
January 1929.	January 1936.	October 1940.	January 1945.
July 1930.	October 1936.	January 1941.	October 1945.
October 1931.	January 1937.	October 1941.	January 1946.
October 1932.	October 1937.	January 1942.	November 1946.
April 1933.	January 1938.	October 1942.	Jan.-Feb. 1947.
October 1933.	October 1938.	January 1943.	
October 1934.	January 1939.	November 1943.	

ACKNOWLEDGMENT.—The Preventive Medicine Division acknowledges the courteous assistance of the Medical Statistics Division in preparing the graphs reproduced as figures 1, 2, and 3.



POLIOMYELITIS: STUDY OF AN EPIDEMIC OF FORTY CASES, KEY WEST, FLORIDA (MAY-AUGUST 1946)

Part II

WILLIAM D. DAVIS
Captain (MC) U. S. N.

and

CHARLES M. SILVERSTEIN
Lieutenant, junior grade (MC) U. S. N. R.

OTHER ADMISSION PHYSICAL FINDINGS

The pulse rate was under 90 per minute in 25 of the patients and went as high as 160 and 178 in two of the other (adult) patients. The respiratory rate was usually normal. Stiffness of the neck and back was usually present, from a very slight to a marked degree. Three of the patients never developed any stiffness or pain on motion of the neck and back. The stiffness was usually much less than that encountered in a meningitis. The Kernig's and Brudzinki's signs were noted in only 7 patients. Eight patients (3 small children and 5 adults) had only very slight stiffness, which, particularly in small children, might have been overlooked by the inexperienced. Indeed, early in the epidemic, the Foundation's physiotherapist demonstrated stiffness in the back of a 17-month-old baby which was completely missed by the medical officer, who had not been in a poliomyelitis epidemic before.

Sixteen of the patients had a mild to marked pharyngitis. In three instances, the symptoms of pharyngitis were quite marked and dominated the admission clinical findings. A mild degree of associated cervical lymphadenopathy was noted only four times.

Six patients had prominent respiratory findings including dyspnea, tachypnea, splinting, and abdominal breathing.

Two-thirds of the patients exhibited weakness or paralysis (extremities, vocal cords, swallowing, muscles of respiration) on admission. In the small children, of course, partial weakness was sometimes difficult to demonstrate.

Reflex changes were only occasionally of value in making an early diagnosis or in predicting the site of involvement. In 11 patients the reflexes were entirely normal on admission. In 4 others the reflexes were generally hyperactive. When the reflexes were hyperactive they were more often bilateral than unilateral. Unilateral diminution or increase in reflexes was occasionally of aid in the early detection of muscle weakness. Usually in the preparalytic stage, the reflexes in an involved limb were at first hyperactive, later becoming diminished

or absent. The abdominals and the knee-jerks showed the most frequent changes (24 patients).

In 18 of the cases, hyperirritability and tremulousness were quite prominent. Four of the patients had definite tremors, involuntary grimacing, and so forth. Marked hyperesthesia was noted twice.

COURSE

The length of the acute stage was usually between 3 and 10 days. The end of the acute stage was defined as the time by which the progression of paralysis or acute symptoms had ended, and the temperature and other findings due to poliomyelitis had returned to or toward normal.

The number of days between the onset of acute symptoms and the onset of paralysis was between 1 to 3 days in all but five of the cases: in one of these, it was 8 days, in another, 24 days.

The number of days of progression of paralysis was usually between 1 and 3 days (averaging 2). Only in one instance was it definitely longer than 4 days.

Case No. 31.

This 7-year-old boy was admitted to the hospital on 30 June 1946 with headache, fever, and aphonia. His illness began 3 days previously with the onset of fever. Headache, fever (100° to 102° F.) and drowsiness continued until admission. Eighteen hours before admission the patient became unable to talk and developed slight dysphagia. No other symptoms.

Related history.—The patient had moved to Key West from Miami 3 weeks before the onset of the present illness. Two close contacts (Nos. 29 and 32) developed poliomyelitis. The family uses a septic tank. At the neighboring house "very ripe" garbage with heavy fly breeding was found.

Admission physical examination.—Temperature 103° F., pulse 120, respiration 45, blood pressure 120/70. A well-developed and nourished white boy. The patient was in a semicomatose state and breathed abdominally. There was no stiffness of the neck or back. The reflexes were not recorded.

Laboratory.—Spinal fluid: white blood cells 31 (3 polymorphonuclear leukocytes, 28 lymphocytes). Protein 15 mg. percent. White blood count 8,600 (with 63 percent polymorphonuclear leukocytes, 35 percent lymphocytes, and 2 percent eosinophils). Urine showed slight trace of albumin.

Hospital course.—The patient remained semicomatose the first 24 hours but was able to void and take a few sips of fluids by mouth. His nail beds were slightly cyanotic. The next day his temperature dropped to 100° F. and he appeared more responsive. The following day his color and dysphagia improved and he responded to questions. He steadily improved and he was able to stand, with uncertain gait, on 4 July 1946 (4 days after admission). The next day muscle evaluation showed no obvious weakness. On 10 July he complained of soreness in the back and pain in the right hamstring group on walking. There was spasm present in this group of muscles and also in the right calf. The next day there was no pain but the right hamstring group was weak. The following 3 days he walked with a limp, but on hot packs, whirlpool baths, and passive exercises the affected limb rapidly improved and by 18 July the affected limb was

entirely normal again. He exhibited no residual changes and was discharged on 20 July.

MUSCLE INVOLVEMENT

Paralysis of various muscle groups was transient in 4 cases (2 days to 2 weeks). In 6 other cases weakness apparently disappeared after a month. In 5 cases there was no apparent paralysis. In the remaining 22 cases paralysis is still present.

Ten cases had transient or prolonged bulbar involvement of one or both upper extremities in the earlier part of the epidemic. There were 3 deaths among the 8 patients who had had bulbar involvement for more than 24 hours, a mortality of 37.5 percent. Death occurred 1, 3, and 5 days after admission. In the earlier part of the epidemic 6 of the first 11 paralytic cases had involvement of the left upper extremity alone. None of the cases since that time had involvement of the left upper extremity alone. The average number of extremities involved in cases with transient or prolonged paralysis was 2 (1.9 percent).

Four cases had involvement of all four extremities. Case No. 26 was of acute ascending and descending paralysis, ending in death.

Case No. 26.

This 19-year-old Army private was admitted on 19 June 1946 complaining of sore throat, fever, headache, and malaise. He was well until 7 days before admission when he became malaised, lethargic, and developed a moderate headache. These symptoms continued. Two days before admission he began to have a sore throat and fever. His neck and back became moderately stiff and uncomfortable. The patient's sister had had poliomyelitis 4 years previously.

Admission physical examination.—Temperature 100° F., pulse 104, respiration 28. Blood pressure 120/76. Examination revealed a moderate rigidity of the neck and to a lesser extent, of the back. There was bilateral hamstring tightness. Reflexes were generally hyperactive. There was general feeling of weakness but there was no muscle weakness.

Laboratory.—Spinal fluid (19 June): White blood cells 179 with 31 polymorphonuclear leukocytes, 148 lymphocytes. Protein 50 mg. percent. (23 June): White blood cells 230 with 2 polymorphonuclear leukocytes, 228 lymphocytes.

Hospital course.—By the next morning, 20 June, stiffness of the neck and back became more pronounced and weakness of the right arm developed. The patient began vomiting frequently and to complain of difficulty in swallowing and inability to take a deep breath. His right arm became limp on 21 June. The patient had pronounced dysphonia and dysphagia and respirations were irregular. In an oxygen tent he got little relief from increasing dyspnea. His left arm became flaccid. He complained of pain in chest and throat and was unable to take a deep breath. His respirations became more regular and he was placed in a respirator (with oxygen) with much relief. His color became mildly cyanotic, however. He had been given constant suction and atropine for mucus. He began having difficulty in moving his legs and was unable to void. The next day, 22 June, his temperature rose from 98° F. to 104° F. He became semicomatose and unable to move his legs or arms. He had been given prophylactic penicillin. His color was constantly cyanotic. On 23 June he

still brought up some mucus, had great difficulty breathing (even in the respirator), and became comatose. A spinal-fluid tap was done in the respirator. He continued to receive oxygen, suction, fluids, enemas, and catheterization. He died the next day.

Case No. 15 is an example of an acute ascending Landry's type which stopped just short of the bulb (transient facial paralysis, dysphagia, and dysphonia). The patient has now been 2 months in an iron lung with nearly complete flaccidity of all four extremities and involvement of muscles of respiration. Her paralysis was complete within 24 hours after it began.

Inability to void occurred from between 1 to 2 days in four patients, 3 days in one patient, and 6 to 7 days in four other patients. These latter five patients included four of the pregnant women and one parturient.

LABORATORY DATA

Spinal fluid.—The number of cells in the spinal fluid bore no correlation to the severity of the disease, and only roughly correlated with the clinical degree of meningeal "irritation." For example, case No. 21, who had only very slight stiffness of back and neck, had 428 cells and developed only mild involvement of the lower extremity. Case No. 40, who had only a slight discomfort in mid-back on bending had 521 cells and did not develop any weakness or paralysis. Case No. 24 had a rigid poker-back and 171 cells, but never developed any weakness.

After doing a great number of spinal-fluid examinations on suspects with almost minimal symptoms and findings (as for example, a member of the patient's family) it soon became apparent that if no signs of meningeal "irritation" were present, the spinal fluid would be negative, even if the history was suggestive. However, careful watchfulness for slight meningeal changes was necessary.

Case No. 34, a WAVE, had questionable stiffness of the neck and back when first seen. She was not sure she had any fever (98.8° F.) Because of a 3-day headache, and aching in the shoulder muscles the patient was admitted for observation and a spinal tap was done. It was negative (Zero white blood cells, 15 mgm. percent protein). Nine hours later there was some definite stiffness in the lower back, discomfort on flexion of the neck, and hyperactive abdominal reflexes. A tap at that time revealed 23 white blood cells, all lymphocytes. Three days later weakness developed in the right lower extremity.

Among the 40 cases the cell count on the spinal fluid varied from a low of zero cells (three cells on repeated tap) to a high of 563 white blood cells per cu. mm. Six patients had over 400 cells. The average was 151 cells per cu. mm. This figure is higher than the usual range given for poliomyelitis (15 to 150). Seventeen, or less than one-half, had less than 100 white blood cells per cu. mm. Only 1 case had less than 10 cells.

Merrit and Fremont-Smith (14) found that the highest white-cell count occurs in the preparalytic stage with the cells predominantly of the polymorphonuclear type. After the onset of paralysis there is sooner or later a shift toward the predominance of lymphocytes.

The present findings concur. All but two of the preparalytic (on admission) cases showed a predominance of polymorphonuclear cells. In addition, one-third of the paralytic cases showed a predominance of polymorphonuclears. Three patients had 97 percent or more polymorphonuclears (97 percent of 405 of cells; 97 percent of 428 cells; and 98 percent of 171 cells). Two others had over 90 percent polymorphonuclears. The fact that many of these patients were seen unusually early in the course of the disease and followed closely may account for the high percentage of polymorphonuclear cells.

Repeated spinal fluid examinations were not done routinely.

The protein findings were of interest. Eight of the ten cases sent to Jackson-Memorial had elevated (over 40 to 45 mg. percent) protein levels. However, only two of the remainder of the cases had elevated spinal fluid proteins. This may have been the result of faulty reagent.

The sugar and chlorides were normal, and no organisms were cultured from the spinal fluids.

Blood.—In slightly over half the cases, the blood count was normal; in the remainder there was a mild leukocytosis. In only three instances was the white count over 12,000, two of these being bulbar cases. The highest count, 17,400, was in a child who also had an acute streptococcus throat. The differential was usually normal. Four children had a relative lymphocytosis varying from 63 percent to 78 percent. There were no atypical lymphocytes seen.

DIFFERENTIAL DIAGNOSIS

There were few problems in differential diagnosis. Cases differentiated from polio-myelitis included acute pharyngitis, gastro-enteritis, torticollis, septicemia, infectious mononucleosis, meningitis, pregnancy, and hysteria.

Case A-5.

This 24-year-old enlisted man was admitted on 28 June 1946 for poliomyelitis observation complaining of backache of 1 day's duration. After lunch he had noticed weakness and dizziness on bending over. In the afternoon a slight headache began, and the patient began to have moderate discomfort and slight stiffness in the small of his back: In the evening he became feverish, and his legs began to feel weak. Related history was negative. One of his close friends was a recent poliomyelitis suspect.

Physical examination.—Temperature 101.6° F., pulse 82, respiration 21. Examination was negative except for slight stiffness and discomfort of the lumbar region. Reflexes were normal.

Spinal fluid.—One white blood cell (lymphocyte), 15 mg. percent protein.

Hospital course.—On 29 June his shoulder muscles ached and his headache increased. There was increased stiffness in the low back which continued the next day. On 1 July the shoulder aches had abated, but the patient still had a mild generalized headache. Repeat spinal fluid examination was negative (zero white blood cell, 10 mg. percent protein). Temperature was normal at this time and the patient felt that he was ready for duty on 2 July. On standing, however, his headache and backache returned, and he was kept in the hospital until 6 July before being discharged.

Impression.—Possible abortive poliomyelitis.

Case A-1.

This 21-year-old WAVE, whose roommate was admitted with a diagnosis of poliomyelitis 4 days previously, was first seen the night before admission, complaining of headache. The generalized headache had begun on 30 June 1946 while the patient was working in the family clinic. It had persisted unabated. Except for a general feeling of tiredness the patient had no other symptoms until the day before admission. The morning of 4 July 1946 she began to notice aching in her neck and upper back. She had no fever. She was examined that night when, except for slight stiffness and tenderness (and accentuation of headache) on bending of the neck, there were no positive findings. Reflexes were normal and there was no evidence of muscle weakness or spasm. The next morning, 5 July 1946, the day of admission, the patient was unable to get out of bed. Her neck and upper back were quite stiff and her headache was severe. She had no fever.

Admission physical examination.—Temperature 98.6° F., respiration 20, pulse 84. The patient was a well-developed and nourished female who appeared acutely ill. The physical examination was negative except for marked stiffness and pain in the neck and back. Headache was marked. Reflexes were normal. No evidence of muscle weakness. The patient appeared somewhat generally weak. She could not sit up.

Spinal fluid.—Zero white blood cells, total protein 15 mg. percent.

Hospital course.—During the patient's first hospital day her neck and back grew stiffer and she grew more uncomfortable. Repeat spinal fluid examinations were negative (2 lymphocytes and 10 mg. percent protein). That night her symptoms reached their peak, and from 7 July 1946 until discharge on 12 July, there was gradual recession of the neckache, backache, stiffness and gradual diminution of the headache. For 3 or 4 days, however, she had marked headache and neckache on standing for more than a few minutes. Throughout her hospital stay her temperature remained normal and she gave no evidence at any time of muscle weakness.

Impression.—Probable abortive poliomyelitis.

Cases A-8 and A-9.

This 4½-year-old boy was admitted for observation 12 July 1946 complaining of pain and stiffness in the left leg causing him to limp. About 5 June he had spent 3 days in bed with fever (102° to 103° F.), sore throat, and headache. About 15 June he began feeling dizzy and dozey, and his legs felt weak. This lasted 2 weeks. Three days later the left leg and thigh began to hurt and tire easily. From that time until admission he complained of some pain and stiffness in his left leg. The day before admission he developed a definite limp. He had no stiffness of the neck or back. He had no further fever.

Examination was negative except for marked spasm of the hamstrings and around the hip on the left. He improved rapidly on whirlpool baths and was allowed to go home after 3 days. No spinal fluid examination was done. He

limped again at home for a couple of days, and then was well. He complained of occasional stiffness in the left thigh, but on subsequent weekly check-ups, no weakness was demonstrated.

The mother of this boy also gave a history of a febrile episode at the same time of his. She also developed a slight limp about the same time he did, but on the right. She had had fever, headache, and slight neck discomfort, but no definite stiffness or pain in neck or back. She was examined by the physiotherapist, who could demonstrate no definite weakness or spasm. After a few days her limp ceased.

Impression.—Possible abortive poliomyelitis.

Case 8-A.

This 22-year-old white mother of a poliomyelitis patient was admitted to the hospital 4 July 1946 with the clinical diagnosis of poliomyelitis, made by her family physician. She complained of aching and stiffness of the neck and back, sore throat, weakness of the right arm and leg. She had been well until 28 June when her menstrual period began. This month and last there had been marked menorrhagia. She had been using at least 24 pads daily, and was so weak that she stayed in bed most of the time. Her periods were regular and usually lasted 10 days. While in bed, a week before her admission, and 1 week after her son was admitted with poliomyelitis, she began noticing a low-grade fever (99° to 100° F), headache (mostly occipital) and persistent drowsiness, hyperirritability, restlessness, and malaise. She remained in bed most of the time. Two days before admission she developed a sore throat which continued until admission. On the same day her right leg became weak (she noticed this when she walked across the room). The day before admission her neck and back became increasingly stiff and ached. Her right arm and leg ached and both became weak (the leg being weaker). She vomited once, complained of dysphagia and some regurgitation of fluids (in answer to questioning). Her headache was still present and she said her temperature was 100° F. the day before admission. When admitted she appeared quite weak, and was still menstruating.

Laboratory.—Spinal fluid: colorless, zero cell count, 10 mg. percent protein. White blood count 9,200 with 58 percent polymorphonuclears (32 segmented neutrophils, 26 nonsegmented neutrophils), 36 percent lymphs, 3 percent eosinophils, 2 percent basophiles and 1 percent monocytes. Red blood count 3.9 million with 80 percent hemoglobin. Urine negative. Sedimentation rate 8 mm/hr. (Westergren).

Admission physical examination.—Temperature 100° F., pulse 80, respiration 20, blood pressure 100/70. The patient had a washed-out appearance, and appeared to be in marked pain and discomfort. She held her neck and back stiff and complained of much tenderness on motion. There was apparent weakness both in the right arm and leg. The physiotherapist noted muscle spasm in the right shoulder girdle and hip. All reflexes were normal. The patient spoke in a very weak voice. She lay very still.

Hospital course and treatment.—Following the admission physical and spinal fluid examination, the patient was admitted to the hospital for observation. Two hours after admission the doctor on call was summoned because the patient began having "muscle spasms" in her hands and arms, and numbness and "drawing" of both hands. The patient exhibited a typical hyperventilation syndrome. There was bilateral carpal spasm and some laryngeal spasm, and the patient (as the hyperventilation increased) complained of marked dyspnea, dysphonia, and dysphagia. Rapidly administered intravenous calcium gluconate stopped the hyperventilation. Then, sodium amytal ($7\frac{1}{2}$ grains) was given

slowly intravenously. The patient became clinically intoxicated, and then readily got up and walked about, without a trace of weakness or stiffness. She began joking with the doctor. After the amytal session, the patient exhibited at no time any evidence of tenderness or stiffness in the neck, back, or other muscles. She had no further complaints and returned home feeling quite well, after 4 days.

Impression.—Hysteria. Possibly mild abortive poliomyelitis.

COMPLICATIONS

Two children (one in Jackson-Memorial, one in Key West) developed chickenpox. One of the pregnant women with a history of pyelitis, had two further episodes of pyelitis, the last one being complicated by septicemia (*E. coli*). This responded to sulfadiazine.

Poliomyelitis had apparently no effect on any of the pregnancies.

TREATMENT

The treatment in general was that followed by The Georgia Warm Springs Foundation. There were special instructions to the nursing staff in the general nursing care, hot packs, baths, passive motion, re-education of muscles and prolonged observation and treatment following the acute disease.

SUMMARY AND CONCLUSIONS

1. The clinical and epidemiologic study of an epidemic of 40 positive cases of poliomyelitis and 190 suspects and probable abortive cases on the island of Key West is presented.

2. The largest percentage of pregnant cases (seven cases) reported in any epidemic occurred here. Six were paralytic. The possible influence of endocrines and vitamins is mentioned.

3. An unusually high percentage (73.7 percent) of cases in naval families were among adults (19 to 33 years of age) whereas only 10.5 percent of the civilian cases were among adults.

4. There were three instances of two positive cases in one family. Thirteen of the remaining thirty-four cases gave a history of a febrile poliomyelitis-like illness in one or more members of the family at the same time.

5. Eight patients had a normal temperature on admission. In an epidemic, this is a point worth emphasizing. Since fever is usually one of the cardinal findings in an infection, a suspected case of poliomyelitis with no fever, but mild symptoms, may be prematurely dismissed. It is important then to routinely inquire about recent fever, or to watch for the subsequent development of fever.

6. In this epidemic a history of direct contact with known positive cases of poliomyelitis was obtained in 18 (almost half) of the cases. Polluted beach water and flies were also possibly incriminated in the

transmission of the virus. Three children, said by their parents to have been completely isolated since the onset of the epidemic, developed poliomyelitis. One case was visited by the mother of an acute case of poliomyelitis, 17 days period to developing symptoms.

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MacClatchie, L. Keith, Captain (MC) USN (*Extragenital Primary Syphilis*, p. 970). B. S., University of Chicago, 1924; M. D., Rush Medical College, 1927. Intern, Presbyterian Hospital, Chicago, Ill., 1926-27; resident, Municipal Contagious Disease Hospital, Chicago, Ill., 1927; intern, U. S. Naval Hospital, Brooklyn, N. Y., 1927-28; postgraduate work in dermatology and syphilology, New York Post-Graduate Medical School and Hospital, Columbia University, 1934-36; private practice, Washington, D. C., 1936-41; civilian appointments formerly held: clinical instructor in dermatology and syphilology, George Washington University School of Medicine and Howard University College of Medicine; attending dermatologist and syphilologist, Episcopal Eye, Ear and Throat Hospital, Washington, D. C.; Columbia Hospital for Women and Lying-In Asylum, Washington, D. C.; visiting physician, Gallinger Municipal Hospital, Washington, D. C., and George Washington University Hospital, Washington, D. C.; associate attending physician, Children's Hospital, Washington, D. C. Appointed assistant surgeon, USN, 25 June 1927; resigned 14 May 1931; appointed past assistant surgeon, USNR, June 1937; transferred to Regular Navy 5 July 1946. Specialty: Dermatology and syphilology. Served at U. S. Naval Dispensary, Recife, Brazil, U. S. Naval Hospital, Naval Operating Base, Norfolk, Va., and U. S. Naval Hospital, San Diego, Calif. Fellow: American Academy of Dermatology and Syphilology; member: American Medical Association and Medical Society of the District of Columbia. Diplomate: American Board of Dermatology and Syphilology.

MacMurtrie, William J., Jr., Lieutenant, junior grade (MC) USNR (*Dual Perforated Peptic Ulcer*, p. 937). B. S., St. Joseph's College, 1940; M. D., University of Pennsylvania School of Medicine, 1943. Intern, Fitzgerald-Mercy Hospital, Darby, Pa., Jan.-Oct. 1944; fellow in surgery, Mayo Foundation, Rochester, Minn., Oct. 1944-Apr. 1946. Appointed ensign, H-V(P), USNR, 22 June 1942; reclassified, apprentice seaman, V-12, USNR, July 1943; appointed assistant surgeon, USNR, 3 Nov. 1943. Specialty: Surgery. Served at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Member: Olmsted-Houston-Fillmore-Dodge Counties Medical Society.

Mee, Edward F., Lieutenant (MC) USN (*A Review of Neurosyphilis*, p. 983). B. S., University of Rochester, 1939; M. D., Northwestern University Medical School, 1942. Intern, U. S. Naval Hospital, Newport, R. I., July 1942-July 1943. Appointed acting assistant surgeon, USN, 16 June 1942 from Illinois. Served at U. S. Naval Dispensary, U. S. Naval Advance Base Personnel Depot, San Bruno, Calif., and U. S. Naval Hospital, Oakland, Calif. Resigned 1 June 1947. Fellow: American Medical Association.

Miller, William W., Jr., Lieutenant (MC) USN (*Bladder Management Following Spinal Injury*, p. 945). A. B., 1939, and M. A., 1941, University of Wisconsin; M. D., University of Wisconsin Medical School, 1943. Instructor, University of Wisconsin, 1940-41. Appointed ensign, H-V(P) USNR, 7 July 1942; appointed acting assistant surgeon, USN, 29 Mar. 1943, from Wisconsin. Specialty: Urology. Intern, U. S. Naval Hospital, Seattle, Wash., 1943-44; resident in urology, U. S. Naval Hospital, Great Lakes, Ill., 1945-47; resident in urology, University of Michigan Hospital, Ann Arbor, Mich., 1947-; served on U. S. S. *Swanson*. Junior fellow: American College of Surgeons; member: American Medical Association.

Owens, J. Cuthbert, Lieutenant Commander (MC) USNR (*Dual Perforated Peptic Ulcer*, p. 937). B. S., College of William and Mary, 1936; M. D., Marquette University School of Medicine, 1941. Intern, Cincinnati General Hospital, Cincinnati, Ohio, 1941-42; assistant resident in surgery, Henry Ford Hospital, Detroit, 1942-43. Appointed assistant surgeon, USNR, 25 Jan. 1943, from Michigan. Served on U. S. *Monrovia*; with amphibious assault operation, Saipan and Marianas islands; and at U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md. Diplomate: National Board of Medical Examiners.

Paynter, Gilman C., Lieutenant (MC) USN (*Bladder Management Following Spinal Injury*, p. 945). B. S., University of Illinois, 1940; M. D., University of Illinois College of Medicine, 1943. Appointed ensign, H-V(P), USNR, 13 Jan. 1942; classification changed to acting assistant surgeon, USN, 9 Apr. 1943, from Illinois. Intern, U. S. Naval Hospital, Naval Operating Base, Norfolk, Va., 17 Apr. 1943-19 Jan. 1944. Served with Destroyer Escort Division 76 and at U. S. Naval Hospital, Great Lakes, Ill. Resigned 28 Apr. 1947.

Pollard, Joseph P., Commander (MC) USN (*Experiences of a Medical Officer in the Air Transport of Patients by the Naval Air Transport Service*, p. 1000). B. S., College of William and Mary, 1935; M. D., University of Virginia Department of Medicine, 1939. Charity Hospital, New Orleans, La., and Gallinger Municipal Hospital, Washington, D. C. Appointed assistant surgeon, USN, 20 Mar. 1941. Specialty: Aviation medicine. Served on U. S. S. *Yorktown* and with U. S. Naval Air Transport Squadron (West Coast Wing and Pacific Wing). Member: American Medical Association.

Robbins, Jacob J., Lieutenant Commander (MC) USN (*Removal of Ureteral Calculi by Catheter Traction With Report of Three Cases*, p. 954). B. A., University of Pennsylvania, 1933; M. D., Jefferson Medical College of Philadelphia, 1938. Intern, St. Joseph's Hospital, Philadelphia, Pa., 1938-39; resident, U. S. Marine Hospital, Baltimore, Md., July 1939-July 1941. Commissioned first lieutenant (MC) USA, 1938-39; assistant surgeon, U. S. P. H. S., 1939-30 June 1942. Appointed assistant surgeon, USNR, June 1942; transferred to Regular Navy, 11 June 1943. Specialty: Urology. Served on U. S. S. *Oberon* and with U. S. Naval Construction Battalion No. 90 and at U. S. Naval Hospital, Naval Operating Base, Norfolk, Va.

Rock, Robert E., Commander (MC) USN (*A Review of Neurosyphilis*, p. 983). B. A., Macalester College, 1923; M. D., University of Minnesota Medical School, 1926. Intern, Northern Pacific Beneficial Association Hospital, St. Paul, Minn., 1926-27; syphilis clinic, Johns Hopkins Hospital, Baltimore, Md., 1936-38. Appointed surgeon, USNR, 10 Feb. 1943, from Tennessee; transferred to Regular Navy, 17 Oct. 1946. Served at U. S. Naval Construction Training Center, Camp Peary, Va., and U. S. Naval Hospital, Oakland, Calif. Member: Nashville Academy of Medicine, Tennessee State Medical Association, and American Medical Association.

Ryan, Thomas C., Commander (MC) USN (*Management of Wounds and Wound Healing*, p. 991). B. S., Canisius College, 1935; M. D., Loyola University School of Medicine, 1939. Appointed acting assistant surgeon, USN, 15 Aug. 1939, from Illinois. Specialty: General surgery. Intern, U. S. Naval Hospital, Philadelphia, Pa., 1939-40; postgraduate course in surgery, Mayo Foundation, Rochester, Minn., 1942; fellow in surgery, Lahey Clinic, Boston, Mass., 1946. Served on U. S. S. *Marblehead*, and at U. S. Navy Mobile Hospital No. 5 and U. S. Naval Hospital, Philadelphia, Pa. Fellow: American Medical Association.

Schenck, Harry P., Captain (MC) USNR (Inactive) (*Mucous Membrane Grafts From the Inferior Turbinate in Reconstruction of the Orbit*, p. 1014). B. S. Haverford College, 1918; M. D., University of Pennsylvania School of Medicine, 1923. Intern, Hospital of the University of Pennsylvania, 1923-25; assistant instructor, otolaryngology, University of Pennsylvania School of Medicine, 1925-26; instructor, 1926-27; associate, 1927-35; assistant professor, 1935-39; professor and head of department, 1939-; lecturer and instructor in pathology, University of Pennsylvania Dental School, 1925-32; assistant professor, 1932-38; associate, otolaryngology, The Medico-Chirurgical College, Graduate School of Medicine, University of Pennsylvania, 1927-37; chief of service, Hospital of the University of Pennsylvania, Philadelphia, Pa., 1939-. Appointed surgeon, USNR, 9 Nov. 1935, from Pennsylvania. Specialty: Otolaryngology. Served on U. S. S. *Solace*; with U. S. Naval Medical Specialists Unit No. 31, and at U. S. Naval Hospital, Ocean-side, Calif. Released from active duty 11 Oct. 1945. Fellow: American College of Surgeons, American Laryngological Association, American Otolological Society; member: American Medical Association, American Academy of Allergy, American Academy of Ophthalmology and Otolaryngology, American Laryngological, Rhinological and Otological Society, College of Physicians of Philadelphia, and Philadelphia Laryngological Society. Diplomate: American Board of Otolaryngology.

Silliphant, William M., Captain (MC) USN (*Eosinophilic Granuloma of Bone*, p. 1068). A. B., University of Southern California, 1926; M. D., Stanford University School of Medicine, 1931. Appointed assistant surgeon, USN, 30 June 1930, from California. Specialty: Pathology. Intern, U. S. Naval Hospital, Mare Island, Calif. Served at U. S. Naval Hospital, Chelsea, Mass.; U. S. Naval Hospital, Pearl Harbor, T. H.; U. S. Naval Hospital, San Diego, Calif.; and U. S. Naval Hospital, Canacao, Cavite, P. I. Prisoner of the Japanese at Bilbid Prison Camp, Manila, 2 Jan. 1942-4 Feb. 1945. Fellow: American Society of Clinical Pathologists, American College of Physicians, and American Medical Association. Diplomate: American Board of Pathology.

Silverstein, Charles M., Lieutenant, junior grade (MC) USNR (*Poliomyelitis: Study of an Epidemic of Forty Cases, Key West, Florida (May-August*

1946); *Part II*, p. 1102). B. A., Emory University, 1941; M. D., Emory University School of Medicine, 1945. Appointed ensign, H-V(P) USNR, 15 Oct. 1942; apprentice seaman, V-12 (S), USNR, May 1943; appointed assistant surgeon, USNR, 6 Mar. 1945. Intern, U. S. Naval Hospital, Key West, Fla., June 1945-March 1946. Served at U. S. Naval Hospital, Dublin, Ga., and U. S. Naval Unit, Warm Springs Foundation.

Veseen, Leslie L., Captain (MC) USN (*Bladder Management Following Spinal Injury*, p. 945). M. D., Loyola University School of Medicine, 1920). Intern, Alexian Brothers' Hospital, Chicago, Ill., 1920-21; assistant to Professor Louis E. Schmidt, Northwestern University Medical School, 1921-27; attending urologist, Cook County Hospital, Chicago, Ill., 1927-41, and Passavant Memorial Hospital, Chicago, Ill., 1936-41; professor, genito-urinary surgery, Cook County Graduate School of Medicine, 1933-41; faculty, department of urology, Northwestern University Medical School, 1926-. Appointed surgeon, USNR, 8 Sept. 1941 from Illinois; transferred to Regular Navy 30 Oct. 1946. Specialty: Urology. Served at U. S. Naval Base Hospital No. 10 and U. S. Naval Hospital, U. S. Naval Training Center, Great Lakes, Ill. Fellow: American College of Surgeons; member: American Medical Association, Illinois State Medical Society, Chicago Medical Society, Chicago Urological Society, and American Urological Association.

Walker, Russell H., Commander (MC) USN (*Preservation of Museum Specimens in Plexiglas*, p. 1086). B. S., University of Oklahoma, 1930; M. D., University of Oklahoma School of Medicine, 1932. Intern, U. S. Marine Hospital, San Francisco, California, 1932-33; resident in surgery, Witaker Hospital, Pryor, Okla., 1933-35; first lieutenant, Medical Reserve, USA, 1935-37. Appointed assistant surgeon, USN, 1 Aug. 1937 from Oklahoma. Specialty: Pathology. Served in the Philippine Islands and in China prior to World War II and with the First Marine Division and on U. S. S. *Tranquillity* during World War II.

Weaver, Edgar N., Lieutenant, junior grade (MC) USNR (*Eosinophilic Granuloma of Bone*, p. 1066). M. D., University of Virginia Department of Medicine, 1943. Enlisted June 1943; appointed assistant surgeon, USNR, 16 Dec. 1943 from Virginia. Specialty: Neurosurgery. Intern, surgery, Dec. 1943-Oct. 1944, assistant resident in neurosurgery, Oct. 1944-June 1945, and resident in neurosurgery, June 1945-Apr. 1946, University of Virginia Hospital, Charlottesville, Va. Served at National Naval Medical Center, Bethesda, Md.

INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN



VOLUME 47

INDEX TO SUBJECTS

[*Indicates Medical and Scientific Notes]

	Page
Accidents resulting from loose dental objects in the mouth.....	517
Acetylcholine on heart, stimulating action of..... *108, *243	110
Acid, ascorbic, in prevention and treatment of disease (editorial).....	*41
Acid, pantothenic, antivitamins for.....	154
Acne, intensive autohemotherapy in the treatment of; a preliminary report..	444
Acromioclavicular dislocations, acute, treatment of.....	817
Acrylic resin denture material.....	171
Acrylic resin, improved separating medium for.....	*51
Action, expectorant, of volatile oils.....	*108, *243
Action, stimulating, of acetylcholine on heart.....	444
Acute acromioclavicular dislocations, treatment of.....	226
Acute coronary insufficiency; a new concept of acute coronary diseases....	514
Acute hematogenous tuberculosis, tuberculosis pericarditis in a case of....	877
Acute hemolytic anemia following the intraperitoneal administration of sulfanilamide; report of a case.....	328
Adenocarcinoma, primary, of the appendix with development of mucus fistula	719
Adjustable appliance for intra-oral immobilization of fractures of the mandibular angle.....	877
Administration, intraperitoneal, of sulfanilamide, acute hemolytic anemia following the; report of a case.....	*457
Adrenal cortex to arthritis, relation of.....	*58
Adrenal discharges, sympathetico-, in hypophysectomized rats.....	*82
Adults, protein requirements of.....	114
Advances in medicine and the medical sciences during 1946.....	249
Aid to problems of a dental officer afloat, a technique for root canal therapy and root resection as.....	926
Air bases, certain naval, incidence of intestinal parasites among civilians employed at.....	77
Aircraft carrier, epidemic of prickly heat on.....	368
Aircraft for the control of mosquitoes, observations on the dispersal of DDT from.....	529
Air sprayer, compressed, description of; malaria control.....	

	Page
Air station, naval, evaluation of a physical training program at-----	473
Air transport of patients by the Naval Air Transport Service, experiences of a medical officer in-----	1000
Air Transport Service, Naval, experiences of a medical officer in the air transport of patients by-----	1000
Alcoholism (editorial)-----	875
Allied repatriates after liberation from Japanese prisons, medical survey of -----	598
Atmospheric blast, intestinal perforation resulting from-----	884
Altitude flight and low-pressure chamber, treatment of whooping cough by--	*662
Analysis, critical, obtained from 873 electroencephalographic examinations--	494
Anaphylactic shock in guinea pigs, use of papaverine hydrochloride in prevention of-----	*32
Anemia, acute hemolytic, following the intraperitoneal administration of sulfanilamide; report of a case-----	877
Anesthesia, spinal, for internes using procaine or novocaine, notes on-----	23
Angle, mandibular, adjustable appliance for intra-oral immobilization of fractures of -----	719
Anniversary, 50th, of the establishment of the Hospital Corps (editorial) --	1045
Anniversary, 40th, of the establishment of the United States Naval Medical Bulletin, April 1907-1947 (editorial)-----	323
Anophelines of the southern United States, infectivity of malarias of foreign origin to-----	*170
Anti-infectious properties of tularemia sera, determinations of-----	*179
Antimalarial drug, new; paludrine (editorial)-----	326
Antivitamins for pantothenic acid-----	*41
Anuria, and oliguria, renal decapsulation in the treatment of-----	959
Appendicitis in a United States naval hospital; a report of 2,404 consecutive cases with emphasis on fatal cases-----	634
Appendix, primary adenocarcinoma of, with development of mucus fistula--	328
Appliance, adjustable, for intra-oral immobilization of fractures of the mandibular angle-----	719
Applicants, enlisted, for submarine training, description of disqualifica- tions of-----	59
Approach, new, to the venereal disease problem (editorial)-----	873
Arachnidism, with report of a case-----	975
Army-Navy medical matériel coordination-----	481
Arsenical compounds, toxic effects of, as employed in the treatment of syphilis in the United States Navy, 1945-----	180
Aspects, certain statistical and social, of diabetes (editorial)-----	1045
Arthritis, relation of the adrenal cortex to-----	*457
Arterial hypertension among naval personnel, symptoms and management of -----	287
Ascorbic acid in the prevention and treatment of disease (editorial)-----	110
Assistant editors, and editors, of the United States Naval Medical Bulletin, 1907-1947 (editorial)-----	323
Asthma, bronchial, insulin shock treatment of-----	*633
Asthma, chronic; results of treatment in 100 cases-----	302
Atabrine, edema of the corneal epithelium caused by-----	*133
Autohemotherapy, intensive, in the treatment of acne; a preliminary re- port-----	154
Axillary vein, idiopathic thrombosis of-----	508

	Page
"B" encephalitis, Japanese; epidemiological report of the 1945 outbreak on Okinawa.....	586
Bankart operation for recurrent dislocation of shoulder.....	672
Bases, certain naval air, incidence of intestinal parasites among civilians employed at.....	926
"Beach foot".....	*22
Benadryl as a therapeutic agent in the treatment of the common cold.....	810
Benadryl in 100 cases, clinical report of the use of.....	812
Bilateral gynecomastia, extragenital choriocarcinoma of the male with; report of a case.....	1072
Births, one and one-half million, in the United States in first five months of 1947 (editorial).....	1047
Bladder management following spinal injury.....	945
Blast, atmospheric, intestinal perforation resulting from.....	884
Blindness and smallpox (editorial).....	505
Blood coagulation, physiology of, and its relationship to some of the common hemorrhagic disorders, review of; with report of a case of unexplained purpura.....	1037
Bone, eosinophilic granuloma of.....	1066
Bone, eosinophilic granuloma of, with report of two cases.....	1058
Blood, human whole, in the Pacific War, distribution and use of.....	396
Bone grafts, primary, report on.....	579
Book review number of the United States Naval Medical Bulletin (editorial).....	872
Bronchial asthma, insulin shock treatment of.....	*633
Brucellosis, human, diagnostic value of opsono-phagocytic reaction in.....	*450
Bulletin, The United States Naval Medical, new publication dates of (editorial).....	109
Bullous dermatitis, fatal, with multiple lesions of the mucous membranes; therapeutic failure of sulfadiazine and penicillin.....	134
Burns.....	391
Calciferol, treatment of lupus vulgaris with.....	*278
Calcifications, multiple pulmonary.....	244
Calculi, ureteral, removal of by catheter traction.....	954
Calculus, salivary, in submaxillary duct and its removal.....	519
Capillary permeability, influence of insulin on.....	*437
Care of dependents in the Navy.....	779
Carrier, aircraft, epidemic of prickly heat on.....	77
Carrier pilots, emotional disturbances encountered in.....	253
Caries, dental, in the cotton rat.....	*271
Case of gas gangrene of neck following extractions.....	521
Case of granuloma pyogenicum treated successfully with penicillin.....	156
Catheter traction, removal of ureteral calculi by.....	954
Cellular division, effect of roentgen rays on.....	*585
Census of specialists in the Medical Corps of the Navy (editorial).....	601
Cerebrospinal fever complicated by extensive thrombotic gangrene of the skin and subcutaneous tissues, with recovery.....	523
Certain statistical and social aspects of diabetes (editorial).....	1045
Chest photofluorograms at the United States Naval Personnel Separation Center, Lido Beach, Long Island, N. Y., review of 283,225.....	749
Chiggers in New Guinea, tests against.....	*89
Children, preschool, nitrogen metabolism of.....	*395

	Page
Critique of tuberculosis control-----	739
Chlorophyll in wound healing and suppurative disease-----	*649
Choriocarcinoma, extragenital, of the male with bilateral gynecomastia; report of a case-----	1072
Chorionepithelioma-----	702
Chronic asthma; results of treatment in 100 cases-----	302
Civilians employed at certain naval air bases, incidence of intestinal para- sites among-----	926
Clock, physiological (editorial)-----	1047
Clinical report of the use of Benadryl in 100 cases-----	812
Congulation, physiology of blood, and its relationship to some of the common hemorrhagic disorders, review of; with report of a case of unexplained purpura-----	1037
Cobalt, iron, and copper, dietary, in metabolism, some interrelationships of-----	*262
Cold, common, Benadryl as a therapeutic agent in the treatment of-----	810
Colic, renal, with special emphasis on crystalluria, treatment of-----	297
Comparative study of efficiency of vaccines in tularemia-----	*480
Comparison of intracutaneous and subcutaneous methods; influenza vacci- nation-----	197
Combat fatigue, diagnosis of-----	850
Compounds, arsenical, toxic effects of, as employed in the treatment of syphilis in the United States Navy, 1945-----	180
Compressed-air sprayer, description of; malaria control-----	529
Compulsory exercise in relation to health (editorial)-----	1048
Congenital pyloric stenosis, hemorrhagic ulcerative gastrojejunitis thirty years after gastroenterostomy for-----	330
Consideration of the significance of hallucinations-----	622
Consultations, 1,000 orthopedic, at a naval dispensary, statistical review-----	827
Containers, glass, tests on the prevention of fracture of, due to freezing of their liquid contents-----	857
Contents, liquid, tests on the prevention of fracture of glass containers due to freezing of-----	857
Control, malaria; description of a compressed-air sprayer-----	529
Control of mosquitoes, observations on the dispersal of DDT from aircraft for-----	368
Control, tuberculosis, critique of-----	739
Coordination, Army-Navy medical matériel-----	481
Copper, iron, and cobalt, dietary, in metabolism, some interrelationships of-----	*262
Corneal epithelium, edema of, caused by atabrine-----	*133
Coronary insufficiency, acute; a new concept of acute coronary disease-----	226
Corps, Navy Medical, graduate training in (editorial)-----	110
Cotton rat, dental caries in-----	*271
Country, desert, instrument sterilization in-----	1019
Critical analysis obtained from 873 electroencephalographic examinations-----	494
Crossroads, medicine at the-----	219
Crystalluria, treatment of renal colic with special emphasis on crystalluria-----	297
Cutaneous leishmaniasis, vaccinothrapy of-----	*477
Cyst, dentigerous; a case report-----	696
Dangerous, most, and shortest, journey in the world (editorial)-----	692
Data, psychiatric, compiled at a United States naval personnel separation center-----	830
Dates, new publication, of The United States Naval Medical Bulletin (editorial)-----	109

	Page
Decapsulation, renal, in treatment of oliguria and anuria.....	959
DDT from aircraft for the control of mosquitoes, observations on the dispersal of.....	368
Defects of the tibia following osteomyelitis due to trauma, osteoplastic repair of.....	683
Defects, physical, found in drafted men in the United States in World Wars I and II (editorial).....	112
Deficiency, vitamin, diseases in allied prisoners of the Japanese.....	272
Delinquent, naval, psychiatric evaluation of.....	458
Dental caries in the cotton rat.....	*271
Dental inactivation in the Reserve Fleet.....	1022
Dental objects, loose, in the mouth, accidents resulting from.....	517
Dental officer afloat, a technique for root canal therapy and root resection as an aid to the problems of.....	249
Dentigerous cyst; a case report.....	696
Denture material, acrylic resin.....	817
Department, Medical, of the Navy, some future policies of.....	1
Dependents in Navy, care of.....	779
Dermatitis, fatal bullous, with multiple lesions of the mucous membranes; therapeutic failure of sulfadiazine and penicillin.....	134
Description of disqualifications of enlisted applicants for submarine training.....	59
Desert country, instrument sterilization in.....	1019
Destroyer, psychometric examinations aboard a.....	27
Determination and treatment of penicillin-resistant gonorrheal urethritis; report of twenty-four cases.....	605
Determinations of anti-infectious properties of tularemia sera.....	*179
Development of mucus fistula, primary adenocarcinoma of the appendix with.....	328
Diabetes, certain statistical and social aspects of (editorial).....	1045
Diabetes mellitus in a naval hospital; review of fifty consecutive cases.....	42
Diagnosis, immunobiological, of tularemia.....	*76
Diagnosis, laboratory, of diphtheria.....	33
Diagnosis of combat fatigue.....	850
Diagnostic and military medico-legal problem; duodenal ulcer and hookworm infestation.....	339
Diagnostic value of opsono-phagocytic reaction in human brucellosis.....	*450
Dietary iron, copper, and cobalt in metabolism, some interrelationships of.....	*262
Differences, fundamental, in the field of medicine in World War II and previous wars (editorial).....	504
Diphtheria, laboratory diagnosis of.....	33
Dirofilaria immitis extract in human filariasis, intradermal tests with.....	824
Discharges, sympathetica-adrenal, in hypophysectomized rats.....	*58
Discoveries, new, in the physiology of the kidney; neurovascular studies of the kidney and their implications (editorial).....	690
Disease, ascorbic acid in prevention and treatment of disease (editorial).....	110
Disease, suppurative, chlorophyll in wound healing and.....	*649
Disease, universal (editorial).....	694
Disease, venereal, incidence of, in searates examined at the U. S. Naval Personnel Separation Center, Jacksonville, Fla.....	207
Disease, venereal, problem, new approach to (editorial).....	873
Diseases, acute coronary, a new concept of; acute coronary insufficiency.....	226
Diseases, concurrent, frequency of syphilis and gonorrhea as (editorial).....	875

	Page
Diseases, vitamin-deficiency, in allied prisoners of the Japanese.....	272
Disqualifications of enlisted applicants for submarine training, description of.....	59
Dislocation, recurrent, of shoulder, Bankart operation for.....	672
Dislocations, acute acromioclavicular, treatment of.....	444
Disorders, common hemorrhagic, review of the physiology of blood coagulation and its relationship to; with report of a case of unexplained pupura.....	1037
Dispensary, naval, statistical review of 1,000 orthopedic consultations at.....	827
Dispersal of DDT from aircraft for the control of mosquitoes, observations on.....	368
Distribution and use of human whole blood in the Pacific War.....	396
Disturbances, emotional, encountered in carrier pilots.....	253
Division, cellular, effect of roentgen rays on.....	*585
Drafted men in the United States in World Wars I and II, physical defects found in (editorial).....	112
Drug, new antimalarial—paludrine (editorial).....	326
Dual perforated peptic ulcer.....	937
Duct, submaxillary, and its removal, salivary calculus in.....	519
Duodenal ulcer and hookworm infestation: diagnostic and military medico-legal problem.....	339
Eczema, nummular, and prostatitis; its treatment with penicillin.....	453
Edema of the corneal epithelium caused by atabrine.....	*133
Editors and assistant editors of the United States Naval Medical Bulletin, 1907-1947 (editorial).....	323
Effect of fat on gastric responses to foods.....	*301
Effect of roentgen rays on cellular division.....	*585
Effects, toxic, or arsenical compounds as employed in the treatment of syphilis in the United States Navy, 1945.....	180
Efficiency of vaccines in tularemia, comparative study of.....	*480
Electroencephalographic examinations, critical analysis obtained from 873.....	494
Electrotome, standard Stern-McCarthy prostatic, to a pistol-grip-trigger model, simple method of converting the.....	717
Elisha Kent Kane, Surgeon, U. S. Navy, story of.....	861
Enlisted applicants for submarine training, description of disqualifications of.....	59
Emotion, the etiologic relation to illness.....	421
Emotional disturbances encountered in carrier pilots.....	253
Encephalitis, Japanese "B"; epidemiological report of the 1945 outbreak on Okinawa.....	586
Eosinophilic granuloma of bone.....	1067
Eosinophilic granuloma of bone, with report of two cases.....	1058
Epidemic of forty cases, Key West, Fla., May-August 1946; poliomyelitis; parts I and II.....	910, 1102
Epidemic of prickly heat on aircraft carrier.....	77
Epidemiological report of the 1945 outbreak on Okinawa; Japanese "B" encephalitis.....	588
Epithelium, edema of the corneal, caused by atabrine.....	*133
Erysipeloid of Rosenbach, treatment of with penicillin.....	150
Establishment of the Hospital Corps, 50th anniversary of (editorial).....	1045
Establishment of the "United States Naval Medical Bulletin," April 1907-April 1947, fortieth anniversary of (editorial).....	323
Evaluation, psychiatric, of the naval delinquent.....	458

	Page
Evaluation of a physical training program at a naval air station.....	473
Eve method of resuscitation.....	650
Examinations, laboratory, for tuberculosis.....	835
Examinations, psychometric, aboard a destroyer.....	27
Examinations, 873 electroencephalographic, critical analysis obtained from..	494
Exercise, compulsory, in relation to health (editorial).....	1048
Expectorant action of volatile oils.....	*51
Experiences of a medical officer in the air transport of patients by the Naval Air Transport Service.....	1000
Extract, <i>Dirofilaria immitis</i> , in human filariasis, intradermal tests with..	824
Extractions, case of gas gangrene of neck following.....	521
Extragenital choriocarcinoma of the male with bilateral gynecomastia; re- port of a case.....	1072
Extragenital primary syphilis.....	970
Facts, and fallacies, in regard to swimming (editorial).....	874
Failure, therapeutic, of sulfadiazine and penicillin; fatal bullous dermatitis with multiple lesions of the mucous membranes.....	134
Fallacies and facts in regard to swimming (editorial).....	874
Fatal bullous dermatitis with multiple lesions of the mucous membranes; therapeutic failure of sulfadiazine and penicillin.....	134
Fat, effect of, on gastric responses to foods.....	*301
Fatigue, combat, diagnosis of.....	850
Fats, studies on the comparative nutritive value of.....	*428
Fever, cerebrospinal, complicated by extensive thrombotic gangrene of the skin and subcutaneous tissues, with recovery.....	523
Fever, rat-bite, with report of a case.....	333
Fever, relapsing, penicillin therapy in; report of four cases.....	238
Fever, rheumatic, in the Negro.....	805
Fever, undulant, treatment of.....	*248
Fiftieth anniversary of the establishment of the Hospital Corps (editorial) ..	1045
Filariasis, human, intradermal tests with <i>Dirofilaria immitis</i> extract in....	824
Fistula, mucus, primary adenocarcinoma of the appendix with development of.....	328
Fleet, Reserve, dental inactivation in the.....	1022
Food in relation to nutrition, preparation and palatability of (editorial) ..	695
Foods, effect of fat on gastric responses to.....	*301
"Foot, beach".....	*22
Foot, repair of soft tissue defects of.....	263
Formulary, National, VIII (editorial).....	694
Fortieth anniversary of the establishment of the "United States Naval Medical Bulletin," April 1907-1947 (editorial).....	323
Fracture of glass containers due to freezing of their liquid contents, tests on the prevention of.....	857
Fractures of the mandibular angle, adjustable appliance for intra-oral immobilization of.....	719
Freezing of their liquid contents, tests on the prevention of fracture of glass containers due to.....	857
Frequency of syphilis and gonorrhea as concurrent diseases (editorial) ..	875
Frozen vitamin standards.....	*457
Fulminating hemolytic <i>Staphylococcus aureus</i> infections; recovery follow- ing penicillin therapy.....	163
Fundamental differences in the field of medicine in World War II and pre- vious wars (editorials).....	504

	Page
Furunculosis with penicillin, local treatment of.....	645
Future policies of the Medical Department of the Navy.....	1
Gangrene, extensive thrombotic, of the skin and subcutaneous tissues, cerebrospinal fever complicated by.....	523
Gangrene, gas, of neck following extractions, case of.....	521
Garré, sclerosing osteomyelitis of, with report of a case.....	83
Gas gangrene of neck following extractions, case of.....	521
Gastric responses to foods, effect of fat on.....	*301
Gastro-enterostomy for congenital pyloric stenosis, hemorrhagic ulcerative gastrojejunitis thirty years after.....	330
Gastrojejunitis, hemorrhagic ulcerative, thirty years after gastro-enter- ostomy for congenital pyloric stenosis.....	330
Genetics and intelligence (editorial).....	506
Glass containers due to freezing of their liquid contents, tests on the pre- vention of fracture of.....	857
Gonococcus infection urethra, penicillin in the treatment of; report of three hundred cases.....	796
Gonorrhea, and syphilis, as concurrent diseases, frequency of (editorial) ..	875
Gonorrhea, single injection therapy for.....	451
Gonorrheal urethritis, penicillin-resistant, determination and treatment of; report of twenty-four cases.....	605
"Good-bye, Mr. Rat".....	*306
Graduate training in the Navy Medical Corps (editorial).....	110
Graft, skin, of the penis.....	715
Grafts, mucous membrane, from the inferior turbinate in reconstruction of the orbit.....	1014
Grafts, primary bone, report on.....	579
Granuloma, eosinophilic, of bone.....	1066
Granuloma, eosinophilic, of bone; report of two cases.....	1058
Granuloma pyogenicum, a case of, treated successfully with penicillin.....	156
Guam, obstetrics on.....	1027
Guam, Schick survey on.....	923
Guillotine operation, improved, and retractor.....	892
Gynecomastia, bilateral, extragenital choriocarcinoma of the male with; report of a case.....	1072
Hallucinations, consideration of the significance of.....	622
Hazards, health, in connection with the industrial handling of thallium, report of investigation of.....	545
Healing, wound, management of wounds and.....	991
Health compulsory exercise in relation to (editorial).....	1048
Health hazards in connection with the handling of thallium, report of investigation of.....	545
Healing, wound, and suppurative disease, chlorophyll in.....	*649
Heart, stimulating action of acetylcholine on.....	*108, *243
Heat, prickly, epidemic of on aircraft carrier.....	77
Hematogenous tuberculosis, acute, tuberculosis pericarditis in a case of....	514
Hemolytic anemia, acute, following the intraperitoneal administration of sulfanilamide; report of a case.....	877
Hemolytic Staphylococcus aureus infections, fulminating; recovery follow- ing penicillin therapy.....	163

	Page
Hemorrhagic disorders, common, review of the physiology of blood coagulation and its relationship to; with report of a case of unexplained purpura.....	1037
Hemorrhagic smallpox; report of a case with recovery; treatment with massive doses of penicillin.....	707
Hemorrhagic ulcerative gastrojejunitis thirty years after gastro-enterostomy for congenital pyloric stenosis.....	330
Hernia, recurrent inguinal; report of two, unusual cases.....	1053
Hookworm infestation, and duodenal ulcer: diagnostic and military medico-legal problem.....	339
Hospital, a United States naval, appendicitis in; a report of 2,404 consecutive cases with emphasis on fatal cases.....	634
Hospital Corps, 50th anniversary of the establishment of the (editorial).....	1045
Hospital, naval, diabetes mellitus in; review of fifty consecutive cases.....	42
Hospital, naval, research in.....	52
Hospital ship, United States Navy, wartime log of to 30 June 1943; part III.....	94
Hospital ship, United States, to June 1943, wartime log of; part IV.....	307
Human leprosy, observations on; infection of rats with human excretal organs.....	*319
Human whole blood in the Pacific War, distribution and use of.....	396
Hydrogen sulfide by <i>Shigella alkalescens</i> , observations on the production of.....	478
Hyperergy to nicotine.....	337
Hypertension, arterial, among naval personnel, symptoms and management of.....	287
Hyperthyroidism, influence of sulfur-containing amino acids (methionine, cystine, and cysteine) on the course of experimental hyperthyroidism.....	*682
Hypophysectomized rats, sympathetico-adrenal discharges in.....	*58
Idiopathic thrombosis of axillary vein.....	508
Immobilization, intra-oral, of fractures of the mandibular angle, adjustable appliance for.....	719
Immunobiological diagnosis of tularemia.....	*76
Immunology of tularemia.....	*477
Improved guillotine operation and retractor.....	892
Improved separating medium for acrylic resin.....	171
Inactivation, dental, in the Reserve Fleet.....	1022
Incidence of intestinal parasites among civilians employed at certain naval air bases.....	926
Incidence of palpable lymph nodes.....	821
Incidence of venereal disease in separatees examined at the U. S. Naval Personnel Separation Center, Jacksonville, Fla.....	207
Industrial handling of thallium, report of investigation of health hazards in connection with the.....	545
Infected, chronically, ingrown toenails, technique of local use of penicillin in the operative treatment of.....	90
Infection of rats with human excretal organs; observations on human leprosy.....	*319
Infections, fulminating hemolytic <i>Staphylococcus aureus</i> ; recovery following penicillin therapy.....	163
Infectious mononucleosis; report of case in a Negro.....	889
Infectivity of malarias of foreign origin to anophelines of the southern United States.....	*170

	Page
Inferior turbinate in reconstruction of the orbit, mucous membrane grafts from-----	1014
Infestation, hookworm, and duodenal ulcer: diagnostic and military medico-legal problem-----	339
Influence of insulin on capillary permeability-----	*437
Influence of sulfur-containing amino acids (methionine, cystine, and cysteine) on the course of experimental hyperthyroidism-----	*682
Influenza vaccination; comparison of intracutaneous and subcutaneous methods-----	197
Ingrown toenails, chronically infected, technique of local use of penicillin in the operative treatment of-----	90
Inguinal hernia, recurrent; report of two unusual cases-----	1053
Injection, single, therapy for gonorrhea-----	451
Injury, spinal, bladder management following-----	945
Instrument sterilization in desert country-----	1019
Insufficiency, acute coronary; a new concept of acute coronary disease-----	226
Insulin on capillary permeability, influence of-----	*437
Insulin shock treatment of bronchial asthma-----	*633
Intelligence and genetics (editorial)-----	506
Intelligence, low, problems in recognizing; subnormal intelligence in the maladjusted naval trainee-----	279
Intelligence, subnormal, in the maladjusted naval trainee; problems in recognizing low intelligence-----	279
Intensive autohemotherapy in the treatment of acne; a preliminary report-----	154
Interrelationships of dietary iron, copper, and cobalt in metabolism-----	*262
Internes using procaine or novocaine, notes on spinal anesthesia for-----	23
Intestinal parasites among civilians employed at certain naval air bases, incidence of-----	926
Intestinal perforation resulting from atmospheric blast-----	884
Intestine, small, nonpenetrating wounds of the-----	698
Intracutaneous and subcutaneous methods, comparison of; influenza vaccination-----	197
Intra-oral immobilization of fractures of the mandibular angle, adjustable appliance for-----	719
Intraperitoneal administration of sulfanilamide; acute hemolytic anemia following; report of a case-----	877
Intradermal tests with <i>Dirofilaria immitis</i> extract in human filariasis-----	824
Investigation of health hazards in connection with the industrial handling of thallium, report of-----	545
Iron, copper, and cobalt, dietary, in metabolism, some interrelationships of-----	*262
Jacksonville, Fla., incidence of venereal disease in separatees examined at the U. S. Naval Personnel Separation Center-----	207
Japanese "B" encephalitis; epidemiological report of the 1945 outbreak on Okinawa-----	586
Japanese prisons, medical survey of allied repatriates after liberation from-----	598
Japanese, vitamin-deficiency diseases in allied prisoners of-----	272
Kane, Elisha Kent, Surgeon, U. S. Navy, story of-----	861
Karyokinesis, radioactivity of potassium and its influence in-----	*604
Key West, Fla. May-August 1946, study of an epidemic of forty cases: poliomyelitis; parts I and II-----	910, 1102

	Page
Kidney, new discoveries in the physiology of; neurovascular studies of the kidney and their implications (editorial)	690
Laboratory diagnosis of diphtheria	33
Laboratory examinations for tuberculosis	835
Leishmaniasis, cutaneous, vaccinothrapy of	*477
Leprosy, human, observations on; infection of rats with human excretal organs	*319
Lesions, multiple, of the mucous membranes, fatal bullous dermatitis with; therapeutic failure of sulfadiazine and penicillin	134
Liberation from Japanese prisons, medical survey of allied repatriates after	598
Lido Beach, Long Island, N. Y., review of 283,225 chest photofluorograms at the United States Naval Personnel Separation Center	749
Liquid contents, tests on the prevention of fracture of glass containers due to freezing of their	857
Local penicillin therapy for tropical ulcer	801
Local treatment of furunculosis with penicillin	645
Local use of penicillin in the operative treatment of chronically infected ingrown toenails, technique of	90
Log, wartime, of a United States Navy hospital ship to 30 June 1943; part III	94
Log, wartime, of a United States Navy hospital ship to June 1943; part IV ..	307
Long-term observation of Plasmodium vivax malaria in the returned serviceman; part I	352
Long-term observation of Plasmodium vivax malaria in the returned serviceman; part II	550
Long-term observation of Plasmodium vivax malaria in the returned serviceman; part III	753
Low pressure chamber, treatment of whooping cough by altitude flight and ..	*662
Lupus vulgaris, treatment of, with calciferol	*278
Lymph nodes, palpable incidence of	821
Lymphogranuloma venereum; report of a case treated with penicillin and sulfadiazine	157
Maladjusted naval trainee, subnormal intelligence in; problems in recognizing low intelligence	279
Malaria control; description of a compressed air sprayer	529
Malaria, Plasmodium vivax, in the returned serviceman, long-term observation of; part I	352
Malaria, Plasmodium vivax, in the returned serviceman, long-term observation of; part II	550
Malaria, Plasmodium vivax, in the returned serviceman, long-term observation of; part III	753
Malarias of foreign origin, infectivity of, to anophelines of the southern United States	*170
Male, extragenital choriocarcinoma of, with bilateral gynecomastia; report of a case	1072
Management, and symptoms, of arterial hypertension among naval personnel	287
Management, bladder, following spinal injury	945
Management of wounds and wound healing	991
Mandibular angle, adjustable appliance for intra-oral immobilization of fractures of	719

	Page
Material, acrylic resin denture.....	817
Measles and tuberculosis, relationship between.....	617
Medical, Army-Navy, matériel coordination.....	481
Medical Bulletin, The United States Naval, new publication dates of (editorial)	109
Medical Corps of the Navy, a census of specialists in the (editorial).....	691
Medical Corps, Navy, graduate training in (editorial).....	110
Medical Department of the Navy, some future policies of.....	1
Medical officer in the air transport of patients by the Naval Air Transport Service, experiences of a.....	1000
Medical sciences and medicine, during 1946, advances in.....	114
Medical specialists in naval service.....	438
Medical Specialists Units, Naval; a proposed plan for their reorganization and continuation.....	429
Medical survey of allied repatriates after liberation from Japanese prisons.....	598
Medicine and the medical sciences during 1946, advances in.....	114
Medicine at the Crossroads.....	219
Medicine in World War II and previous wars, fundamental differences in the field of (editorial).....	504
Medicine, military, and tetanus (editorial).....	505
Medico-legal, military, and diagnostic problem; duodenal ulcer and hook-worm infestation.....	339
Medium, improved separating, for acrylic resin.....	171
Mellitus, diabetes, in a naval hospital; review of fifty consecutive cases....	42
Membrane, mucous, grafts from the inferior turbinate in reconstruction of the orbit.....	1014
Men, drafted, in the United States in World Wars I and II, physical defects found in (editorial).....	112
Metabolism, nitrogen, of preschool children.....	*395
Metabolism, some interrelationships of dietary iron, copper, and cobalt in.....	*262
Method, Eve, of resuscitation.....	650
Method, simple, of converting the standard Stern-McCarthy prostatic electrotome to a pistol-grip-trigger model.....	717
Methods, intracutaneous and subcutaneous, comparison of; influenza vaccination.....	197
Methyl salicylate poisoning; a report of two cases and review of the literature	1077
Military medicine and tetanus (editorial).....	505
Mononucleosis, infectious; report of case in a Negro.....	889
Mosquitoes, observations on the dispersal of DDT from aircraft for the control of.....	368
Mouth, accidents resulting from loose dental objects in.....	517
Mucus fistula, primary adenocarcinoma of the appendix with development of	328
Mucous membranes, fatal bullous dermatitis with multiple lesions of the; therapeutic failure of sulfadiazine and penicillin.....	134
Mucous membrane grafts from the inferior turbinate in reconstruction of the orbit.....	1014
Multiple lesions of the mucous membranes, fatal bullous dermatitis with; therapeutic failure of sulfadiazine and penicillin.....	134
Multiple pulmonary calcifications.....	244

	Page
Museum specimens, preservation of, in Plexiglas.....	1086
National Formulary VIII (editorial).....	694
Naval air station, evaluation of a physical training program at.....	473
Naval Air Transport Service, experiences of a medical officer in the air transport of patients by the.....	1000
Naval delinquent, psychiatric evaluation of.....	458
Naval dispensary, statistical review of 1,000 orthopedic consultations at....	827
Naval hospital, a United States, appendicitis in; a report of 2,404 consecutive cases with emphasis on fatal cases.....	634
Naval hospital, diabetes mellitus in; review of fifty consecutive cases.....	42
Naval hospital, research in.....	52
Naval Medical Bulletin, questionnaire on (editorial).....	1049
Naval Medical Specialists Units; a proposed plan for their reorganization and continuation.....	429
Naval personnel, symptoms and management of arterial hypertension among	287
Naval service, medical specialists in.....	438
Naval trainee, subnormal intelligence in the maladjusted; problems in recognizing low intelligence.....	279
Naval, United States, Medical Bulletin, new publication dates of (editorial)	109
Navy, United States, hospital ship, wartime log of, to 30 June 1943; part III.....	94
Navy, United States, hospital ship to June 1943, wartime log of; part IV....	307
Navy Medical Corps, graduate training in (editorial).....	110
Navy, some future policies of the Medical Department of the.....	1
Neck, case of gas gangrene of, following extractions.....	521
Negro, report of case of infectious mononucleosis in.....	889
Negro, rheumatic fever in the.....	805
Neurosyphilis, review of.....	983
Neurovascular studies of the kidney and their implications: new discoveries in the physiology of the kidney (editorial).....	690
New antimalarial drug—paludrine (editorial).....	326
New approach to the venereal disease problem (editorial).....	873
New discoveries in the physiology of the kidney: neurovascular studies of the kidney and their implications (editorial).....	690
New Guinea, tests against chiggers in.....	*89
New publication dates of The United States Naval Medical Bulletin (editorial)	109
Nicotine, hyperergy to.....	337
Nitrogen metabolism of preschool children.....	*395
Nodes, palpable lymph, incidence of.....	821
Nonpenetrating wounds of the small intestine.....	698
Notes on spinal anesthesia for internes using procaine or novocaine.....	23
Novocaine, notes on spinal anesthesia for internes using procaine or.....	23
Nodular eczema and prostatitis; its treatment with penicillin.....	453
Nutrition, preparation and palatability of food in relation to (editorial)...	695
Nutritive, comparative, value of fats, studies on.....	*428
Objects, loose dental, in the mouth, accidents resulting from.....	517
Observation, long-term, of Plasmodium vivax malaria in the returned serviceman; part I.....	352

	Page
Observation, long-term, of <i>Plasmodium vivax</i> malaria in the returned serviceman; part II.....	550
Observation, long-term, of <i>Plasmodium vivax</i> malaria in the returned serviceman, part III.....	753
Observations on human leprosy; infection of rats with human excretal organs.....	*19
Observations on the dispersal of DDT from aircraft for the control of mosquitoes.....	368
Observations on the production of hydrogen sulfide by <i>Shigella alkaescens</i>	478
Observations, urologic and ophthalmologic, in two cases of Reiter's syndrome.....	657
Obstetrics on Guam.....	1027
Ocular prosthesis, plastic.....	5
Officer, dental, afloat, technique for root canal therapy and root resection as an aid to the problems of.....	249
Oils, volatile, expectorant action of.....	*51
Okinawa, epidemiological report of the 1945 outbreak on; Japanese "B" encephalitis.....	586
Oliguria and anuria, renal decapsulation in the treatment of.....	959
One and one-half million births in the United States in First Five Months of 1947 (editorial).....	1047
Ophthalmologic, and urologic, observations in two cases of Reiter's syndrome.....	657
Operation, Bankart, for recurrent dislocation of shoulder.....	672
Operation, improved guillotine, and retractor.....	892
Operative treatment of chronically infected ingrown toenails, technique of local use of penicillin in.....	90
Opsono-phagocytic reaction in human brucellosis, diagnostic value of.....	*450
Orbit, mucous membrane grafts from the inferior turbinate in reconstruction of the.....	1014
Orthopedic consultations at a naval dispensary, statistical review of 1,000.....	827
Osteomyelitis due to trauma, osteoplastic repair of defects of the tibia following.....	683
Osteomyelitis, sclerosing, of Garré with report of a case.....	83
Osteoplastic repair of defects of the tibia following osteomyelitis due to trauma.....	683
Outbreak on Okinawa, epidemiological report of the 1945; Japanese "B" encephalitis.....	586
Pacific War, distribution and use of human whole blood in.....	396
Palatability, and preparation, of food in relation to nutrition (editorial)....	695
Palpable lymph nodes, incidence of.....	821
Paludrine—new antimalarial drug (editorial).....	326
Pantothenic acid, antivitamins for.....	*41
Papaverine hydrochloride in prevention of anaphylactic shock in guinea pigs, use of.....	*32
Parasites, intestinal, among civilians employed at certain naval air bases, incidence of.....	926
Pathologists, plea for (editorial).....	507
Patients, by the Naval Air Transport Service, experiences of a medical officer in the air transport of.....	1000
Penicillin, a case of granuloma pyogenicum treated successfully with.....	156

	Page
Penicillin and sulfadiazine, report of a case of lymphogranuloma venereum treated with.....	157
Penicillin and sulfadiazine, therapeutic failure of; fatal bullous dermatitis with multiple lesions of the mucous membranes.....	134
Penicillin in the operative treatment of chronically infected ingrown toenails, technique of local use of.....	90
Penicillin in the treatment of gonococcus infection urethra; report of three hundred cases.....	796
Penicillin, local treatment of furunculosis with.....	645
Penicillin-resistant gonorrheal urethritis, determination and treatment of; report of twenty-four cases.....	605
Penicillin therapy in relapsing fever; report of four cases.....	238
Penicillin therapy, local, for tropical ulcer.....	801
Penicillin therapy, recovery following; fulminating hemolytic Staphylococcus aureus infections.....	163
Penicillin, treatment of erysipeloid of Rosenbach with.....	150
Penicillin treatment for syphilis, pericarditis during.....	141
Penicillin, treatment with massive doses of; hemorrhagic smallpox; report of a case with recovery.....	707
Penicillin, treatment with nummular eczema and prostatitis.....	453
Penicillin, yaws treated with single massive doses of.....	965
Peptic ulcer, dual perforated.....	937
Peptic ulcers, vagotomy in treatment of.....	785
Pericarditis during penicillin treatment for syphilis.....	141
Pericarditis, tuberculosis, in a case of acute hematogenous tuberculosis....	514
Perforated peptic ulcer, dual.....	937
Perforation, intestinal, resulting from atmospheric blast.....	884
Permeability, capillary, influence of insulin on.....	*437
Penis, skin graft of.....	715
Personnel, naval and Marine Corps, routine photofluorographic examinations of; and results.....	733
Personnel, naval, symptoms and management of arterial hypertension among.....	287
Personnel separation center, a United States naval, psychiatric data compiled at.....	830
Pharmacopoeia XIII, United States (editorial).....	693
Photofluorograms, 283,225 chest, at the United States Naval Personnel Separation Center, Lido Beach, Long Island, N. Y., review of.....	749
Photofluorographic examinations, routine, of naval and Marine Corps personnel; end results.....	733
Physical defects found in drafted men in the United States in World Wars I and II (editorial).....	112
Physical training program at a naval air station, evaluation of.....	473
Physiology of blood coagulation and its relationship to some of the common hemorrhagic disorders, review of; with report of a case of unexplained purpura.....	1037
Physiological clock (editorial).....	1047
Physiology of the kidney, new discoveries in; neurovascular studies in the kidney and their implications (editorial).....	690
Pilots, carrier, emotional disturbances encountered in.....	253
Plasmodium vivax malaria in the returned serviceman, long-term observation of; part I.....	352

	Page
Plasmodium vivax malaria in the returned serviceman, long-term observation of; part II.....	550
Plasmodium vivax malaria in the returned serviceman, long-term observation of; part III.....	753
Plastic ocular prosthesis.....	5
Plea for pathologists (editorial).....	507
Plexiglas, preservation of museum specimens in.....	1086
Poisoning, methyl salicylate; a report of two cases and review of the literature.....	1077
Policies, some future, of the Medical Department of the Navy.....	1
Poliomyelitis: Study of an epidemic of forty cases, Key West, Fla., May-August 1946; part I.....	910
Poliomyelitis: Study of an epidemic of forty cases, Key West, Fla., May-August 1946; part II.....	1102
Potassium and its influence in karyokinesis, radioactivity of.....	*604
Power of punctuation (editorial).....	326
Precommissioning center, psychiatric screening tests at.....	676
Preparation and palatability of food in relation to nutrition (editorial).....	695
Preschool children, nitrogen metabolism of.....	*395
Preservation of museum specimens of Plexiglas.....	1086
Prevention and treatment of disease, ascorbic acid in (editorial).....	110
Prevention of anaphylactic shock in guinea pigs, use of papaverine hydrochloride in.....	*32
Prevention of fracture of glass containers due to freezing of their liquid contents, test on.....	857
Prickly heat on aircraft carrier, epidemic of.....	77
Primary adenocarcinoma of the appendix with development of mucus fistula.....	328
Primary bone grafts, report on.....	579
Primary syphilis, extragenital.....	970
Prisoners, allied, of the Japanese, vitamin-deficiency diseases in.....	272
Prisons, Japanese, medical survey of allied repatriates after liberation from.....	598
Problems in recognizing low intelligence; subnormal intelligence in the maladjusted naval trainee.....	279
Problems of a dental officer afloat, technique for root canal therapy and root resection as an aid to.....	249
Procaine or novocaine, notes on spinal anesthesia for internes using.....	23
Production of hydrogen sulfide by Shigella alcalescens, observations on Program, physical training, at a naval air station, evaluation of.....	478
Prostatic electrotome, standard Stern-McCarthy, to a pistol-grip-trigger model, simple method of converting the.....	473
Prosthesis, plastic ocular.....	717
Prostatitis, nummular eczema and; its treatment with penicillin.....	5
Prostatitis, nummular eczema and; its treatment with penicillin.....	453
Protein requirements of adults.....	*82
Psychometric examinations aboard a destroyer.....	27
Psychiatric data compiled at a United States naval personnel separation center.....	830
Psychiatric evaluation of the naval delinquent.....	458
Psychiatric screening tests at a precommissioning center.....	676
Publication dates, new, of the United States Naval Medical Bulletin (editorial).....	109

	Page
Pulmonary calcification, multiple.....	244
Punctuation, power of (editorial).....	326
Purpura, unexplained, report of a case of; review of the physiology of blood coagulation and its relationship to some of the common hemorrhagic disorders.....	1037
Pyloric stenosis, congenital, hemorrhagic ulcerative gastrojejunitis thirty years after gastro-enterostomy for.....	330
Questionnaire on the Naval Medical Bulletin (editorial).....	1051
Radioactivity of potassium and its influence in karyokinesis.....	*604
Rat-bite fever with report of a case.....	333
Rat, cotton, dental caries in.....	*271
Rat, Mr., goodbye.....	*306
Rats, hypophysectomized, sympathetico-adrenal discharges in.....	*58
Rats, infection of, with human excretal organs; observations on human leprosy.....	*319
Reaction, opsono-phagocytic, in human brucellosis, diagnostic value of....	*450
Reactions, toxic, in the treatment of syphilis in the U. S. Navy in 1946....	1095
Recognizing low intelligence, problems in; subnormal intelligence in the maladjusted naval trainee.....	279
Reconstruction of the orbit, mucous membrane grafts from the inferior turbinate in.....	1014
Reconstruction of the thumb.....	880
Recovery following penicillin therapy; fulminating hemolytic Staphylococcus aureus infections.....	163
Recurrent dislocation of shoulder, Bankart operation for.....	672
Recurrent inguinal hernia; report of two unusual cases.....	1053
Reiter's syndrome, urologic and ophthalmologic observations in two cases of.....	657
Relation of the adrenal cortex to arthritis.....	*457
Relationship between measles and tuberculosis.....	617
Relapsing fever, penicillin therapy in; report of four cases.....	238
Removal of ureteral calculi by catheter traction.....	954
Renal colic with special emphasis on crystalluria, treatment of.....	297
Renal decapsulation in the treatment of oliguria and anuria.....	959
Repair, osteoplastic, of defects of the tibia following osteomyelitis due to trauma.....	683
Repair of soft tissue defects of the foot.....	263
Repatriates, allied, after liberation from Japanese prisons, medical survey of.....	598
Report, clinical, of the use of Benadryl in 100 cases.....	812
Report, epidemiological of the 1945 outbreak on Okinawa; Japanese "B" encephalitis.....	586
Report of investigation of health hazards in connection with the industrial handling of thallium.....	545
Report on primary bone grafts.....	579
Requirements, protein, of adults.....	*82
Reserve Fleet, dental inactivation in the.....	1022
Research in the naval hospital.....	52
Resection, root, and root canal therapy, technique for as an aid to the problems of a dental officer afloat.....	249
Resin, acrylic, denture material.....	817

	Page
Resin, acrylic, improved separating medium for.....	171
Results of treatment in 100 cases; chronic asthma.....	302
Resuscitation, Eve method of.....	650
Retractor, improved guillotine operation and.....	892
Review, book, number of the United States Naval Medical Bulletin (editorial).....	872
Review of neurosyphilis.....	983
Review of the physiology of blood coagulation and its relationship to some of the common hemorrhagic disorders; with report of a case of unex- plained purpura.....	1037
Review of 283,225 chest photofluorograms at the United States Naval Per- sonnel Separation Center, Lido Beach, Long Island, N. Y.....	749
Review, statistical, of 1,000 orthopedic consultations at a naval dispensary.....	827
Rheumatic fever in the Negro.....	805
Rh factor.....	603
Roentgen rays on cellular division, effect of.....	*585
Root canal therapy and root resection as an aid to the problems of a dental officer afloat, technique for.....	249
Root resection and root canal therapy, technique for as an aid to the prob- lems of a dental officer afloat.....	249
Routine photofluorographic examinations of naval and Marine Corps per- sonnel; end results.....	733
Salicylate, methyl, poisoning; a report of two cases and review of the litera- ture.....	1077
Salivary calculus in submaxillary duct and its removal.....	519
Sarcoma of the soft tissues; discussion and report of eight cases.....	1005
Schick survey on Guam.....	923
Sciences, medical, and medicine, during 1946, advances in.....	114
Sclerosing osteomyelitis of Garré with report of a case.....	83
Screening tests, psychiatric, at a precommissoning center.....	676
Separatees examined at the U. S. Naval Personnel Separation Center, Jack- sonville, Fla., incidence of venereal disease in.....	207
Separating medium, improved, for acrylic resin.....	171
Separation center, a United States naval, psychiatric data compiled at.....	830
Sera, tularemia, determinations of anti-infectious properties of.....	*179
Serviceman, returned, long-term observation of Plasmodium vivax malaria in; part I.....	352
Serviceman, returned, long-term observation of Plasmodium vivax malaria in; part II.....	550
Serviceman, returned, long-term observation of Plasmodium vivax malaria in; part III.....	753
Service, naval, medical specialists in.....	438
Shigella alkalescens, observations on the production of hydrogen sulfide by.....	478
Ship, use of Wangenstein suction aboard.....	343
Ship, United States Navy hospital, wartime log of to 30 June 1943; part III.....	94
Ship, United States Navy hospital, to June 1943, wartime log of; part IV.....	307
Shock, anaphylactic, in guinea pigs, use of papaverine hydrochloride in pre- vention of.....	*32
Shock, insulin, treatment of bronchial asthma.....	633

	Page
Shortest and most dangerous journey in the world (editorial).....	692
Shoulder, Bankart operation for recurrent dislocation of.....	672
Simple method of converting the standard Stern-McCarthy prostatic electrotome to a pistol-grip-trigger model.....	717
Single injection therapy for gonorrhea.....	451
Skin and subcutaneous tissues, cerebrospinal fever complicated by extensive thrombotic gangrene of.....	523
Skin graft of the penis.....	715
Smallpox and blindness (editorial).....	505
Smallpox, hemorrhagic; report of a case with recovery; treatment with massive doses of penicillin.....	707
Social, and certain statistical, aspects of diabetes (editorial).....	1045
Soft tissues, sarcoma of; discussion and report of eight cases.....	1905
Some future policies of the Medical Department of the Navy.....	1
Some interrelationships of dietary iron, copper, and cobalt in metabolism.....	*262
Specialists in the Medical Corps of the Navy, census of (editorial).....	691
Specialists, medical, in naval service.....	438
Specialists Units, Naval Medical; a proposed plan for their reorganization and continuation.....	429
Specimens, museum, preservation of, in Plexiglas.....	1086
Spinal anesthesia for internes using procaine or novocaine, notes on.....	23
Spinal injury, bladder management following.....	945
Sprayer, compressed air, description of; malaria control.....	529
Standards, frozen vitamin.....	*457
Station, naval air, evaluation of a physical training program at.....	473
Statistical, certain, and social aspects of diabetes (editorial).....	1045
Statistical review of 1,000 orthopedic consultations at a naval dispensary.....	827
Staphylococcus aureus infections, fulminating hemolytic; recovery following penicillin therapy.....	163
Stenosis, congenital pyloric, hemorrhagic ulcerative gastrojejunitis thirty years after gastro-enterostomy for.....	330
Sterilization, instrument, in desert country.....	1019
Stern-McCarthy, standard, prostatic electrotome to a pistol-grip-trigger model, simple method of converting the.....	717
Stimulating action of acetylcholine on the heart.....	*108, *243
Story of Elisha Kent Kane, Surgeon, U. S. Navy.....	861
Studies on the comparative nutritive value of fats.....	*428
Subcutaneous and intracutaneous methods, comparison of; influenza vaccination.....	197
Subcutaneous tissues, cerebrospinal fever complicated by extensive thrombotic gangrene of skin and.....	523
Submarine training, description of disqualifications of enlisted applicants for.....	59
Submaxillary duct and its removal, salivary calculus in.....	519
Subnormal intelligence in the maladjusted naval trainee; problems in recognizing low intelligence.....	279
Suction, Wangensteen, aboard ship, use of.....	343
Sulfadiazine and penicillin, report of a case of lymphogranuloma venereum treated with.....	157
Sulfadiazine and penicillin, therapeutic failure of; fatal bullous dermatitis with multiple lesions of the mucous membranes.....	134

	Page
Sulfanilamide, acute hemolytic anemia following the intraperitoneal administration of; report of a case.....	877
Sulfur-containing amino acids (methionine, cystine, and cysteine) on the course of experimental hyperthyroidism, influence of.....	682
Sulfide, hydrogen, by <i>Shigella alkalescens</i> , observations on the production of	478
Suppurative disease, chlorophyll in wound healing and.....	*649
Survey, medical, of allied repatriates after liberation from Japanese prisons	598
Survey, Schick, on Guam.....	923
Swimming, fallacies and facts in regard to (editorial).....	874
Sympathetico-adrenal discharges in hypophysectomized rats.....	*58
Syndrome, Reiter's, urologic and ophthalmologic observations in two cases of	657
Syphilis and gonorrhea as concurrent diseases, frequency of (editorial)....	875
Syphilis, extragenital primary.....	970
Syphilis in the U. S. Navy in 1946, toxic reactions in the treatment of.....	1095
Syphilis, treatment of, in the United States Navy, 1945, toxic effects of arsenical compounds as employed in.....	180
Syphilis, pericarditis during penicillin treatment for.....	141
Symptoms and management of arterial hypertension among naval personnel	287
Technique for root canal therapy and root resection as an aid to the problems of a dental officer afloat.....	249
Technique of local use of penicillin in the operative treatment of chronically infected ingrown toenails.....	90
Tests against chiggers in New Guinea.....	*89
Tests, intradermal, with <i>Diofilaria immitis</i> extract in human filariasis.....	824
Tests on the prevention of fracture of glass containers due to freezing of their liquid contents.....	857
Tests, psychiatric screening, at a precommissioning center.....	676
Tetanus and military medicine (editorial).....	505
Thallium, report of investigation of health hazards in connection with the industrial handling of.....	545
Therapeutic agent, Benadryl as a, in treatment of the common cold.....	810
Therapeutic failure of sulfadiazine and penicillin; fatal bullous dermatitis with multiple lesions of the mucous membranes.....	134
Therapy, local penicillin, for tropical ulcer.....	801
Therapy, penicillin, in relapsing fever; report of four cases.....	238
Therapy, penicillin, recovery following; fulminating hemolytic <i>Staphylococcus aureus</i> infections.....	163
Therapy, root canal and root resection, technique for as an aid to the problems of a dental officer afloat.....	249
Therapy, single injection, for gonorrhea.....	451
Thrombosis, idiopathic, of axillary vein.....	508
Thrombotic gangrene, extensive, of the skin and subcutaneous tissues, cerebrospinal fever complicated by.....	523
Thumb, reconstruction of.....	880
Tibia, defects of, following osteomyelitis due to trauma, osteoplastic repair of	683
Tinea capitis.....	159

	Page
Tissue, soft, defects of the foot, repair of.....	263
Tissues, soft, sarcoma of; discussion and report of eight cases.....	1005
Tissues, subcutaneous, cerebrospinal fever complicated by extensive thrombotic gangrene of the skin and.....	523
Toenails, chronically infected ingrown, technique of local use of penicillin in the operative treatment of.....	90
Toxic effects of arsenical compounds as employed in the treatment of syphilis in the United States Navy, 1945.....	180
Toxic reactions in the treatment of syphilis in the U. S. Navy in 1946.....	1095
Traction, catheter, removal of ureteral calculi by.....	954
Trainee, naval, subnormal intelligence in the maladjusted; problems in recognizing low intelligence.....	279
Training, graduate, in the Navy Medical Corps (editorial).....	110
Training, physical, program at a naval air station, evaluation of.....	473
Training, submarine, description of disqualifications of enlisted applicants for	59
Transport, air, of patients by the Naval Air Transport Service, experiences of a medical officer in the.....	1000
Transport Service, Naval Air, experiences of a medical officer in the air transport of patients by the.....	1000
Trauma, osteoplastic repair of defects of the tibia following osteomyelitis due to.....	683
Treatment, and determination, of penicillin-resistant gonorrheal urethritis; report of twenty-four cases.....	605
Treatment, and prevention, of disease, ascorbic acid in (editorial).....	110
Treatment in 100 cases, results of; chronic asthma.....	302
Treatment, insulin shock, of bronchial asthma.....	*633
Treatment, local, of furunculosis with penicillin.....	645
Treatment of acne, intensive autohemotherapy in; a preliminary report....	154
Treatment of acute acromioclavicular dislocations.....	444
Treatment of erysipeloid of Rosenbach with penicillin.....	150
Treatment of gonococcus infection urethra, penicillin in; report of three hundred cases.....	796
Treatment of lupus vulgaris with calciferol.....	*278
Treatment of oliguria and anuria, renal decapsulation in the.....	959
Treatment of peptic ulcers, vagotomy in.....	785
Treatment of renal colic with special emphasis on crystalluria.....	297
Treatment of syphilis in the United States Navy, 1945, toxic effects of arsenical compounds as employed in.....	180
Treatment of syphilis in the U. S. Navy in 1946, toxic reactions in.....	1095
Treatment of the common cold, Benadryl as a therapeutic agent in.....	810
Treatment of whooping cough by altitude flight and low pressure chamber.....	*662
Treatment, operative, of chronically infected ingrown toenails, technique of local use of penicillin in.....	90
Treatment, penicillin, for syphilis, pericarditis during.....	141
Treatment of undulant fever.....	*218
Treatment with massive doses of penicillin; hemorrhagic smallpox; report of a case with recovery.....	707
Treatment with penicillin; nummular eczema and prostatitis.....	453
Tropical ulcer, local penicillin therapy for.....	801
Tuberculosis, acute hematogenous, tuberculosis pericarditis in a case of....	514
Tuberculosis control, critique of.....	739

	Page
Tuberculosis, laboratory examinations for.....	835
Tuberculosis pericarditis in a case of acute hematogenous tuberculosis....	514
Tuberculosis, relationship between measles and.....	617
Turbinate, inferior, in reconstruction of the orbit, mucous membrane grafts from.....	1014
Tularemia, comparative study of efficiency of vaccines in.....	*480
Tularemia, immunobiological diagnosis of.....	*76
Tularemia, immunology of.....	*477
Tularemia sera, determinations of anti-infectious properties of.....	*179
Ulcer, dual perforated peptic.....	937
Ulcer, duodenal, and hookworm infestation : diagnostic and military medico- legal problem.....	339
Ulcer, tropical, local penicillin therapy for.....	801
Ulcerative gastrojejunitis, hemorrhagic, thirty years after gastro-enteros- tomy for congenital pyloric stenosis.....	330
Ulcers, peptic, vagotomy in treatment of.....	785
Undulant fever, treatment of.....	*248
United States naval hospital, appendicitis in ; a report of 2,404 consecutive cases with emphasis on fatal cases.....	634
United States Naval Medical Bulletin, April 1907-April 1947, fortieth anniversary of the establishment of (editorial).....	323
United States Naval Medical Bulletin, book review number of (editorial) ..	872
United States Naval Medical Bulletin, new publication dates of (editorial) ..	109
United States Naval Medical Bulletin, 1907-1947, editors and assistant editors of (editorial).....	323
United States naval personnel separation center, psychiatric data com- piled at.....	330
United States Navy hospital ship to 30 June 1943 ; part III.....	94
United States Navy hospital ship to June 1943, wartime log of ; part IV....	307
United States Pharmacopoeia XIII (editorial).....	693
Units, Naval Medical Specialists ; a proposed plan for their reorganization and continuation.....	429
Universal disease (editorial).....	694
Ureteral calculi by catheter traction, removal of.....	954
Urethra, gonococcus infection, penicillin in the treatment of ; report of three hundred cases.....	797
Urethritis, penicillin-resistant gonorrheal, determination and treatment of ; report of twenty-four cases.....	605
Urologic and ophthalmologic observations in two cases of Reiter's syn- drome.....	657
Use and distribution of human whole blood in the Pacific War.....	396
Use, local, of penicillin in the operative treatment of chronically infected ingrown toenails, a technique of.....	90
Use of Benadryl in 100 cases, clinical report of.....	812
Use of papaverine hydrochloride in prevention of anaphylactic shock in guinea pigs.....	*32
Use of Wangenstein suction aboard ship.....	343
Vaccination, influenza ; comparison of intracutaneous and subcutaneous methods.....	197
Vaccines in tularemia, comparative study of efficiency of.....	*480
Vaccinotherapy of cutaneous leishmaniasis.....	*477

	Page
Vagotomy in treatment of peptic ulcers.....	785
Value, diagnostic of opsono-phagocytic reaction in human brucellosis.....	*450
Vein, axillary, idiopathic thrombosis of.....	508
Venereal disease, incidence of, in searatees examined at the U. S. Naval Personnel Separation Center, Jacksonville, Fla.....	207
Venereal disease problem, new approach to (editorial).....	873
Vitamin-deficiency diseases in allied prisoners of the Japanese.....	272
Vitamin standards, frozen.....	*457
Wangensteen suction, use of, aboard ship.....	343
War, Pacific, distribution and use of human whole blood in.....	396
War II, World, and previous wars, fundamental differences in the field of medicine in (editorial).....	504
Wartime log of a United States Navy hospital ship to 30 June 1943; part III.....	94
Wartime log of a United States Navy hospital ship to June 1943; part IV..	307
Whooping cough, treatment of, by altitude flight and low-pressure chamber..	*662
World Wars I and II, physical defects found in drafted men in the United States in (editorial).....	112
World War II and previous wars, fundamental differences in the field of medicine in (editorial).....	504
Wound healing and suppurative disease, chlorophyll in.....	*649
Wound healing, and wounds, management of.....	991
Wounds and wound healing, management of.....	991
Wounds, nonpenetrating, of the small intestine.....	698
Yaws treated with single massive doses of penicillin.....	985



INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN



VOLUME 47

INDEX TO AUTHORS

	Page		Page
Aaberg, Monrad E.....	1027	Carter, John R.....	1066
Albers, Donald D.....	33	Casterline, Joan E.....	478
Anderson, Laura T.....	180	Caveny, Elmer L.....	421
Arje, Sidney L.....	965	Charter, Wilbur V.....	733
Aston, Melville J.....	94, 307	Cohen, Lawrence J.....	702
Auerbach, Oscar.....	226	Cohn, Robert.....	352, 550, 753
Barksdale, Edwin E.....	810	Collet, Henry A., Jr.....	815
Barnes, LaVerne A.....	478	Cooper, Irving S.....	338
Barnett, Garold S.....	529	Cragg, Richard W.....	1072
Bartlett, Neil R.....	59	Crile, George, Jr.....	328
Bean, Lawrence L.....	715	Dandurant, Duwane D.....	343
Bell, Luther G.....	937	Davis, William D.....	908, 1102
Bew, David F.....	749	Dawson, Clarence E.....	1019
Bianco, Anthony A.....	352, 550, 753	Draeger, R. Harold.....	219
Bibler, Lester D.....	207	Duemling, Werner W.....	605
Billman, Dallas E.....	975	Dufresne, Napoleon E.....	197
Boles, Robert D.....	157	Dyke, Joseph S.....	453
Bongiovanni, Alfred M.....	27	Entin, Moses J.....	157
Boshes, Louis D.....	458	Erdman, Robert F.....	1022
Brewster, John M.....	808	Fallander, Stanley R.....	368
Bricker, Arnold G.....	924	Ferguson, Lewis K.....	150
Britten, Sidney A.....	733	Fett, Herbert C.....	579
Brooks, Angus M.....	23	Fink, Harold.....	882
Brown, Herbert R., Jr.....	396	Fitzgerald, Patrick J.....	134
Brown, Robert B.....	1053	Frazier, Shervert H.....	163
Burton, Otto L.....	180	Funk, Wylma F.....	833
Caes, Henry J.....	1072	Furlong, Joseph J.....	42
Cahill, William F.....	519	Gerry, Roger G.....	719
Camp, Turner.....	451	Gilbert, C. Louis.....	514
Campbell, Vernon W. H.....	481	Glenn, Clarence G.....	328
Canaga, Bruce L., Jr.....	1037	Goley, William H.....	207
Cancelmo, Jesse J., Jr.....	1077	Goren, Sidney.....	545
Carpenter, Cedric C.....	453	Greenspan, Frances S.....	197
Carson, Leon D.....	650	Gunther, Walter A.....	444, 683

	Page		Page
Gutch, Charley F.....	799	Morgan, Russell E.....	529
Haines, Richard D.....	514	Mosher, William E., Jr.....	586
Hall, William K.....	810	Moss, John E.....	599
Hamm, William G.....	263	Mrazek, Charles.....	890
Hand, Eugene A.....	150	Nardini, John E.....	272
Hardy, S. Baron.....	263	Niiranen, John V.....	5
Harris, LaMar W.....	171	Nuckolls, Chester R.....	453
Haynes, Lewis L.....	1053	Olenick, Everett J.....	657
Hays, Thomas G.....	330	Owens, J. Cuthbert.....	937
Hildreth, Harold M.....	52	Patterson, John B.....	878
Holleb, Arthur I.....	1005	Paynter, Gilman C.....	945
Horton, Samuel H., Jr.....	605	Peabody, Sherman M.....	77
Howell, S. Robert.....	855	Pinto, Joseph C.....	650
Huebsch, Raymond F.....	696	Pollard, Joseph P.....	1000
Hull, Donald B.....	1058	Pote, Harry H.....	337
Hunt, William.....	663	Pugh, H. Lamont.....	391
Hurlbut, Herbert S.....	368	Requarth, William H.....	253
Husman, Chester N.....	368	Reuter, Frederick L.....	333
Hutchins, Hal C.....	517	Ribble, George B.....	77
Jackson, Minter M.....	279	Richeson, Paul J.....	154
Jacobziner, Harold.....	921	Robbins, Frederick R.....	634
Jeffreys, Frank E.....	171	Robbins, Jacob J.....	954
Johnson, Howard A.....	875	Rock, Robert E.....	983
Justyn, George W.....	180	Ross, Bernard.....	154
Kern, Richard A.....	94, 307, 429	Rossen, Ralph.....	494
Kley, Edward C.....	702	Rupe, Lloyd O.....	156
Knutson, Donald L.....	617	Ryan, Thomas C.....	991
Lancaster, William M.....	249	Saferstein, T. Harry.....	238
Lape, Charles P.....	90	Sargent, James W.....	657
Lawler, Arthur L.....	795	Saunders, George M.....	352, 550, 753
Legge, Robert F.....	825	Schenck, Harry P.....	1014
Levine, Arnold S.....	352, 550, 753	Schlack, Carl A.....	855
Liles, John H., Jr.....	645	Schwab, Robert S.....	828
Lockward, Howard J.....	156	Sessions, Howard K.....	545
Lowe, Edward S.....	783, 959	Shaul, John F.....	238
Luedemann, Waldo S.....	77	Shelesnyak, Moses C.....	859
Lyons, Harold A.....	83, 739	Sheppard, Raymond R.....	529
Mabrey, Roy E.....	698	Shilling, Charles W.....	59
MacClatchie, L. Kelth.....	970	Sideman, Sidney.....	683
MacCreary, Donald.....	924	Silliphant, William M.....	1058
MacMurtrie, William J.....	937	Silverstein, Charles M.....	908, 1102
Maher, Walter E. J.....	749	Smalley, Raymond E.....	287
Maple, John D.....	368	Smith, Donald S.....	302
Master, Arthur M.....	226	Smith, Jarvis M.....	579
McClelland, Warren S.....	707	Snell, William E.....	444
Mee, Edward F.....	983	Solomon, Philip.....	848
Metcalfe, John W.....	672	Stalnaker, Paul R.....	297
Miller, Walter R.....	508	Steiner, Morris.....	523
Miller, William W., Jr.....	717, 945	Stewart, Daniel N., Jr.....	887
Monat, Henry A.....	338	Stott, Ardenne A.....	702
Moore, Roland C.....	676	Strauch, James H.....	150
Moorman, Warren W.....	819	Stubenbord, John G., 3d.....	473

	Page		Page
Stubenbord, William D.....	159	Warden, Cyrus E.....	521
Swanson, C. A.....	1	Warren, Shields.....	219
Taylor, Ralph W.....	696	Weaver, Edgar N.....	1006
Theis, Frank V.....	163	Weeks, Kenneth D.....	707
Thomas, Marcel P.....	617	Whitehead, Hugh G., Jr.....	141
Tilney, Robert W., Jr.....	749	Wickstrom, Otto W.....	878
Titus, Paul.....	438	Will, Otto Allen, Jr.....	622
Van Gelder, David W.....	197	Willcutts, Morton D.....	777
Veseen, Leslie L.....	945	Wilson, Charles S.....	368
Vesey, John M.....	803	Woelfel, George F.....	508
Wagner, Carruth J.....	343	Wyman, Alvin C.....	244
Walker, Russell H.....	1086	Zeligs, Mendel.....	822
Walters, Waltman.....	330		



PREFACE



THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

CLIFFORD A. SWANSON,
Surgeon General, United States Navy.

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Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the BULLETIN should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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